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ABSTRACT

This curriculum guide contains operational guidelines to help local administrators, teacher educators, and industrial arts teachers in the State of Louisiana determine the extent to which their basic metals courses are meeting the needs of the youth they serve. It consists of a discussion of course prerequisites, goals, content, and implementation as well as 16 units devoted to various subject areas addressed in a basic metals course. Covered in the units are general safety, basic metalworking tools, layout, bench metalwork, sheet metal, art metal, ornamental metalwork, forging, metal casting, welding, metal finishing, planning, careers in metalworking, and basic metals projects. Each unit contains some or all of the following: objectives, time allotments, suggested topics, student activities, teacher activities, resources, and a unit inventory listing necessary tools and equipment. Among those items appended to the guide are safety rules, steps in making a layout, samples of basic metals projects, a sample student-planning sheet, suggestions for measuring achievement, sample test questions, techniques for conducting classes and for motivating students, and a list of resource materials. (MN)

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STATE OF LOUISIANA

DEPARTMENT OF EDUCATION

BULLETIN No. 1685

INDUSTRIAL ARTS CURRICULUM GUIDE

IN

BASIC METALS

September, 1982

Office of Vocational Education

N. J. Stafford, Jr., Ed.D.
Assistant Superintendent

J. KELLY NIX
State Superintendent

CE 034 374

U.S. DEPARTMENT OF EDUCATION
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Foreword

This publication is a guide for the improvement of instruction in Industrial Arts Education for the State of Louisiana. It should be of benefit to industrial arts teachers, supervisors, counselors, and administrators. These operational guidelines will help local administrators, teacher educators, and industrial arts teachers to determine the extent to which their programs are meeting the needs of our youth. Industrial Arts Education Programs must be organized to meet the needs of all students.

A constant concern for educators is the construction and revision of curriculum. Industry and technology are the core of industrial arts instruction. Both are constantly changing; therefore, curriculum and instruction must change in order to provide students a realistic and accurate understanding of industry and its function in our complex technological society.

J. KELLY NIX
State Superintendent of Education

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The following teachers spent many hours writing, field testing, and completing these guidelines: Bob Bitowski, Jimmy Ware, Charley Johnson, and William H. Bostick.

N. J. Stafford

N. J. Stafford, Jr., Ed.D.
Assistant Superintendent
Office of Vocational Education

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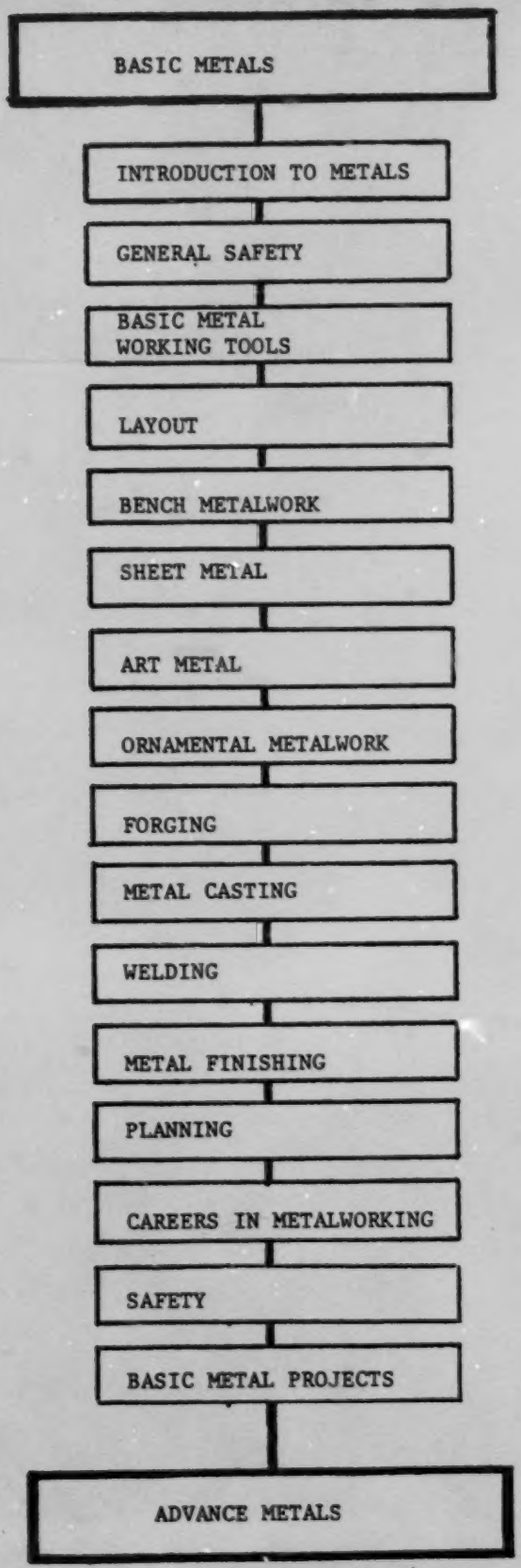
BASIC METALS
INTRODUCTION TO METALS
GENERAL SAFETY
BASIC METAL WORKING TOOLS
LAYOUT
BENCH METALWORK
SHEET METAL
ART METAL
ORNAMENTAL METALWORK
FORGING
METAL CASTING
WELDING
METAL FINISHING
PLANNING
CAREERS IN METALWORKING
SAFETY
BASIC METAL PROJECTS
ADVANCE METALS

Title:

Basic Metals

Course Description:

Basic Metals involves the use of tools, materials, processes, and related information in the design, planning, construction, and finishing of metal products in metalworking areas such as bench metal, sheet metal, metal casting, forging, ornamental metalwork, art metal, and welding.

Target Grade Levels:

Grades 10 - 12.

Prerequisite:

General Industrial Arts

Course Goals:

In Basic Metals, the student will become acquainted with occupational opportunities in this field of work, and should develop an appreciation of the metals industries as it relates to our everyday environment. Experiences will be provided through the logical process of planning, problem solving, evaluation, research, and manipulative "hands on" skills. The study of Basic Metals cannot be conducted in depth, but it must be thorough enough to develop basic understanding of and skill in the use of tools and machines common to metalworking industries.

Course Objectives:

To provide exploratory experiences in several metalwork areas so as to develop an understanding of an appreciation in technology in the metals industries.

To teach the necessary related information and develop the essential skills needed in the design, fabrication, heat treating (where applicable), and finishing of industrial products for pre-vocational and avocational pursuits.

To develop safe work habits.

To increase understanding of the occupational requirements and opportunities in the metal fields.

To provide problem solving situations and give opportunities to use and apply the math and science skills developed and studies in other subjects.

Introduction

This is an age of metal. In almost every activity of our lives we use metal articles which in turn were made by metal machines. The metalworking industries in the United States employ more workers than any other industries. Highly specialized metal trades and industries offer many worthwhile careers. By studying and participating in the various Basic Metal areas as outlined in this course, students will have the opportunity to learn the basic knowledge and develop the manipulative skills used in the metalworking industry.

Basic Metals is designed as the first stepping stone for a student who is entering the highly skilled field of metals. The course is broken down into seven major fields: bench metal, sheet metal, art metal, ornamental metalwork, forging, casting, and welding.

The student will be exposed to the fundamental technical knowledge in all of these fields of metals as well as the practical "hands on" experiences. These opportunities will be provided through a variety of individually constructed projects. Also basic metal working tools, layout techniques, industrial processes, analysis of employment trends, and planning will be taught. In addition to these areas, safe use of all hand and power tools, equipment and material handling will be taught in the course.

Suggested Time Allotment

The suggested time frame for Basic Metals is 174 days. The remaining 6 days are to be used as necessary for the opening and closing of the metals laboratory, school functions, and in units where the instructor feels additional time is needed.

If time dictates that this course must be taught in one semester, rather than a full 180 day school year, Units I through VII (Introduction to Metals - Art Metal) should be covered.

BASIC METALS

A COURSE OUTLINE

I. INTRODUCTION TO METALS

A. Properties

1. Brittleness
2. Ductility
3. Elasticity
4. Tensile Strength
5. Hardness
6. Malleability

B. Classifications

1. Ferrous
   a. Iron
      (1) Iron ore, coke, limestone
      (2) Pig iron
      (3) Cast iron
      (4) Wrought iron
      (5) Steel
   b. Steel
      (1) Carbon--mild, medium, high
      (2) Alloy--high speed, special
      (3) Ways to make steel
2. Non-ferrous
   a. Aluminum
   b. Brass
   c. Tin
3. Alloy
   a. Stainless steel
   b. Nickel steel
   c. Magnesium
4. Base metal
   a. Gold
   b. Copper
   c. Lead
   d. Silver

C. Identification

1. Surface appearance
2. Sound
3. Spark test
4. Melting point

5. Grain structure
6. Color coding
7. Metal shapes
8. Number system
   a. S.A.E.
   b. A.I.S.I.

II. GENERAL SAFETY

A. Review General Safety Rules

(See Appendix)

B. Classroom Safety Rules

(See Appendix)

III. BASIC METALWORKING TOOLS

A. Hand Tools

1. Vise
2. Hammers
3. Screwdrivers
4. Pliers
5. Wrenches
6. Files
7. Chisels
8. Saws

B. Power Tools

1. Power hacksaw
2. Band saw
3. Hand drill
4. Drill press
5. Portable grinder and sander
6. Grinder

C. Safety

1. Hand tools
2. Power tools

IV. LAYOUT

A. Tools and Uses

1. Steel rules

2. Scriber
3. Squares
   a. Combination
   b. Adjustable
   c. Solid
4. Calipers
   a. Hermaphrodite
   b. Inside
   c. Outside
5. Dividers
6. Trammel
7. Protractor
8. Surface gauge
9. Layout fluid
10. Punches
    a. Prick
    b. Center
11. V-Blocks

B. Procedures and Techniques

(See Appendix)

C. Safety

1. Sharp tool care
2. Material handling

V. BENCH METALWORK

A. Hand Cutting Processes

1. Saws
   a. Hacksaw
      (1) Blade selection
      (2) Safety
2. Chisels
   a. Types
      (1) Flat
      (2) Cape
      (3) Round nose
      (4) Diamond point
   b. Uses
      (1) Cutting
      (2) Shearing
      (3) Chipping
   c. Safety

3. Files
   a. Classification
      (1) Single - cut
      (2) Double - cut
      (3) Rasp
      (4) Curved - tooth
   b. Shapes
      (1) Flat
      (2) Square
      (3) Half round
      (4) Round
   c. Uses
      (1) Cut
      (2) Smooth
      (3) Fit parts together
   d. Safety
4. Abrasives
   a. Classification
      (1) Natural
         (a) Emery
         (b) Garnet
         (c) Diamond
      (2) Artificial (man made)
         (a) Silicon carbide
         (b) Aluminum oxide
         (c) Boron carbide
   b. Safety

B. Power Cutting Process

1. Saws
   a. Power hacksaw
   b. Band saw
   c. Abrasive cut-off saw
   d. Safety
2. Grinders
   a. Bench
   b. Protable
   c. Pedestal
   d. Safety
3. Drills and drilling machines
   a. Types of drills
      (1) Straight flute
      (2) Twist drill
   b. Sizes
      (1) Numbered
      (2) Lettered
      (3) Fractions
      (4) Drill gauge

c. Holding device
(1) Vise
(2) V-block
d. Drilling machines
(1) Portable
(2) Drill press
3. Safety

C. Striking Tools

1. Machinist's hammer (ball peen)
2. Soft faced hammer
a. Plastic
b. Rubber
c. Rawhide
d. Lead
3. Safety

D. Threading

1. Types of threads
a. American National thread system
b. National coarse (NC)
c. National Fine (NF)
2. Internal threading
a. Taps
(1) Taper
(2) Plug
(3) Bottoming
b. Holding device
(1) T-handle
(2) Tap wrench
3. External threads
a. Dies
(1) Solid
(2) Adjustable round
(3) Two-piece adjustable
b. Holding device
(1) Die stock
4. Safety

E. Clamping

1. Vises
2. Clamps
a. C-clamps
b. Vise grips
3. Protective caps
a. Wood
b. Copper
c. Sheet metal
4. Safety

F. Tightening

1. Wrenches
   a. Adjustable
      (1) Pipe
      (2) Crescent
      (3) Slip-joint pliers
      (4) Channel-locks
   b. Non-adjustable
      (1) Open end
      (2) Box end
      (3) Sockets
      (4) Spanner
2. Screwdrivers
   a. Standard
   b. Phillips head
3. Safety

G. Fastening

1. Screws
   a. Machine
      (1) Round head
      (2) Oval head
      (3) Flat head
      (4) Others
   b. Cap screws
   c. Set screws
   d. Self-tapping screws (sheet metal)
   e. Thread cutting
2. Bolts
   a. Machine
   b. Stud
3. Nuts
   a. Hex nut
   b. Square nut
   c. Wing nut
   d. Cap nut
4. Rivets
   a. Button head
   b. Counter sunk
   c. Flat head
   d. Pan head
   e. Blind rivet (pop rivet)
5. Setting a rivet

VI. SHEET METAL

A. Pattern Making

1. Parallel line development
   a. Prisms
   b. Cylinders
2. Radial line development
   a. Cones
   b. Pyramids

B. Hand Tools

1. Hand snips
   a. Circular
   b. Straight
   c. Aviation
2. Punches
   a. Hollow
   b. Solid
3. Sheet metal gauge
4. Hammers
   a. Riveting
   b. Setting
   c. Mallet
5. Hand seamer
6. Hand groover
7. Soldering copper
8. Safety

C. Floor Machines and Equipment

1. Machines
   a. Squaring shear
   b. Bar folder
   c. Box and pan brake
   d. Slip roll forming machine
   e. Combination rotary machine
   f. Notcher
   g. Portable power shears
2. Equipment
   a. Universal stake holder
   b. Stakes
   c. Bench shear
3. Safety

D. Bending and Shaping Operations

1. Hems
   a. Single
   b. Double

2. Edges
    a. Wired
    b. Burr
    c. Crimped
3. Seams
    a. Lap
    b. Flat lock groove
    c. Double seam
    d. Corner seam
4. Safety

E. Sheet Metal Fastening

1. Riveting
2. Screwing
3. Soldering
    a. Flux
    b. Solder
4. Spot welder
5. Safety

VII. ART METAL

A. Tools

1. Jeweler's saw
2. Jeweler's file
3. Wood block
4. Mushroom stake
5. Sand bag
6. Hammers
    a. Planishing
    b, Forming
    c. Raising

B. Sawing and Piercing

C. Raising

D. Chasing

E. Beating Down

F. Planishing

VIII. ORNAMENTAL METALWORK (WROUGHT METAL)

A. Hand Bending

1. Tools
   a. Vise
   b. Hammer
   c. Monkey wrench
   d. Bending jig
2. Types of bends
   a. Angle
   b. Twist
   c. Scroll
   d. Circle
3. Safety

B. Machine Bending

1. Di-acro bender
2. Universal bender
3. Metal former
4. Hossfeld scroll bender
5. Safety

IX. FORGING

A. Hand Forging Tools

1. Anvil
2. Tongs
   a. Straight lip
   b. Curved lip
   c. Pick up
3. Hammers
   a. Sledge
   b. Cross peen
   c. Ball peen
4. Safety

B. Machine Forging

C. Hand Forging Techniques

1. Upsetting
2. Bending
3. Drawing out
4. Safety

D. Furnace

1. Lighting
2. Operation
3. Shut down
4. Safety

E. Heat Treating

1. Types
   a. Annealing
   b. Case hardening
   c. Tempering
   d. Hardening
2. Temperature control by color
3. Safety

X. METAL CASTING

A. Sand Casting

1. Patterns
   a. Simple (one piece)
   b. Split
      (1) Positive draft
      (2) Negative draft
2. Tools
   a. Flask
   b. Sprue and riser
   c. Ram
   d. Bottom board
   e. Riddle
   f. Strike off bar
   g. Lifter, slick and oval
3. Molding sand
   a. Tempering sand
4. Furnace equipment
   a. Crucible furnace
   b. Tongs
   c. Crucible
5. Safety

B. Other Types of Casting

1. Shell mold
2. Investment
3. Permanent
4. Die casting

XI. WELDING

A. Gas Welding

1. Tools and equipment
   a. Oxygen and acetylene cylinder
   b. Regulators
   c. Hoses
   d. Torch
   e. Tips: cutting, welding, heating
   f. Striker
   g. Goggles and gloves
   h. Flux and filler rod
2. Setting up equipment
3. Lighting torch
4. Adjusting equipment
5. Gas operations
   a. Welding
   b. Cutting
   c. Brazing
6. Safety

B. Arc Welding

1. Tools and equipment
   a. Arc welding machine
   b. Helmet and gloves
   c. Chipping hammer
   d. Wire brush
   e. Electrodes
   f. Protective clothing
2. Setting up equipment
3. Striking arc
4. Welding in flat position
5. Safety

XII. METAL FINISHING

A. Hand and Machine Finishing

1. Brushing
2. Sanding
3. Polishing
4. Buffing
5. Painting
6. Spraying
7. Dipping

XIII. PLANNING

A. Review of Working Drawings

1. Assembly drawing
2. Detail drawing
   a. Dimensions
   b. Views

B. Basic Principles of Design and Construction

1. Lines
2. Proportion
3. Balance
4. Emphasis
5. Texture
6. Color

C. Review of Measurement and Shop Mathematics

1. Reading a rule (review)
   a. 12" rule to 1/16"
   b. Metric: 1 meter to 1 millimeter
2. Shop math review

D. Individual Project Drawing

1. Selection of project
2. Rough sketch
3. Teacher's evaluation of sketch
4. Final drawing (working)

E. Bill of Material

1. Part number
2. Number of pieces (quantity)
3. Part name
4. Material
5. Size: thickness, width, length
6. Unit cost
7. Total cost

F. Plan of Procedure

1. Operations (list)
2. Tools (list)
3. Equipment (list)

XIV. CAREERS IN METALWORKING

A. Levels of Skill

1. Semi-skilled
2. Skilled
3. Technicians
4. Professions

B. Classifications of Occupations

1. Steelworker (iron worker)
2. Welder
3. Tool and die maker
4. Sheet metal technician
5. Machinist
6. Others

C. Methods of Training

1. High school
2. Vo-Tech school
3. College
4. Apprenticeship

XV. SAFETY

A. Review Safety on all Units

B. Safety Test

(80% or better to be permitted to work)

XVI. BASIC METALS PROJECTS

A. Bench Metal Work

B. Sheet Metal

C. Art Metal

D. Ornamental Ironwork

E. Forging

F. Casting

G. Welding

UNIT I: INTRODUCTION TO METALS - 5 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The Student will be able to identify the six different properties of metal.	A. Properties 1. Brittleness 2. Ductility 3. Elasticity 4. Tensile Strength 5. Hardness 6. Malleability	1) Have student look up, list and define properties in notebook 2) Other recommended activities a. have student break a piece of cast iron and explain property involved b. have a student stretch a piece of copper wire and explain property involved	Lecture, discussion, demonstration, supervision of experiment. Filmstrip: if available in your area.	1) p.247 2) pp.51-59 to 52-58 3) pp.10-22 4) pp.396-397
The student will be able to list and describe the four classifications of metals.	B. Classifications 1. Ferrous a. iron (1) iron ore, coke, limestone (2) pig iron (3) cast iron (4) wrought iron (5) steel b. Steel (1) carbon--mild, medium, high (2) alloy--high speed, special (3) ways to make steel	After lecture and notes; pass around available metal samples and have students identify	Show different types of metals that are easily obtainable Hot roll steel Cold roll steel Brass Aluminum Copper, etc.	1) p.9 2) Cp.1,pp.10-12 3) pp.31-36 4) pp.397-403
The student will be able to list different metals in each classifications.	2. Non-Ferrous a. aluminum b. brass c. tin 3. Alloy a. stainless steel b. nickel steel c. magnesium 4. Base Metal a. gold b. copper c. lead d. tin			1) pp. 9-14 2) Cp.1,p.13 3) pp.36-41 4) pp.422-424 1) pp.8-14 2) pp.1,19-22 3) pp.437-441 4) pp.94,401,402 1) pp.8-14 2) Cp.1,pp.19-22 3) p.4 4) pp.422-424

UNIT I INTRODUCTION TO METALS (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify different metals by use of one or more of the identification processes.	C. Identification 1. Surface appearance 2. Sound 3. Spark test 4. Melting point 5. Grain structure 6. Color coding 7. Metal shapes 8. Number system a. SAE b. AISI	After lecture and notes have student identify metals by one of the identification processes. Test number 1. Unit 1.	Show the students the various shapes of metal available in your shop Make a display board of the various shapes and sizes of metals found in your shop. Have an advanced student speak to the class on what he got out of the class and why he registered for the advanced class.	1) p.13 2) cp.1,pp.12-14 3) p.47 4) pp.43,44,406 407

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UNIT II GENERAL SAFETY 2 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will review the basic safety rules taught in general shop. The student will be able to understand and be responsible for the classroom safety rules.	A. Review General Safety Rules 1. (See safety rule list in appendix) B. Classroom Safety Rules 1. (see classroom safety rules in appendix)	The student will be able to explain and apply general shop practices in the metals lab.	Lecture, discussion, hand-outs, display (broken safety classes, etc.) Filmstrip: if available in your area. Make bulletin board with comic strip characters, showing students.	1) pp.31-34 2) Cp.3,pp.1-3 3) pp.103-118 4) pp.5-7 Appendix and your school and safety rules

UNIT III BASIC METALWORKING TOOLS 3 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The students should be able to identify and describe the proper use of hand and power tools.	A. Hand Tools 1. vise 2. hammers 3. screwdrivers 4. pliers 5. wrenches 6. files 7. chisels 8. saws	Name and describe function of tools on display and explain safety rules pertaining to each. List and define uses of the common hand and power tools in student notebook.	Lecture - Exhibit or display of hand and power tools. Using the tool room panel, show example of the basic metalworking tools that are in the shop.	1) pp.48-65 2) Units 7,8,9,10, 12,13,15,16,17. 3) pp.179,186 4) pp.70-76
	B. Power Tools 1. power hacksaw 2. band saw 3. hand drill 4. drill press 5. portable grinder and sander 6. grinder		Filmstrip: if available to you in your area.	1) pp.55-59 2) Unit 33,34,35 3) pp.248-250,181 4) Chapters 7,8,14
The student will be able to use, transport and sharpen all given tools and machines.	C. Safety 1. hand tool 2. power tool		Demonstrate the safe and unsafe use of each tool and power tool procedures (ask for student comments).	

UNIT INVENTORY - UNIT III

BASIC METAL WORKING TOOLS

Basic Tools		Supplementary Tools
(5)	Machinist Hammer (Ball Peen	(1) Mechanical Wheel Dresser
(1)	Plastic Mallet	
(2)	Rubber Mallet	
(1)	4" Standard Screwdriver	
(2)	6" Standard Screwdriver	
(1)	8" Standard Screwdriver	
(1)	#0 Phillips Screwdriver	
(2)	#1 Phillips Screwdriver	
(1)	#2 Phillips Screwdriver	
(3)	6" Slip Joint Pliers	
(1)	6" Adjustable Wrench (Crescent)	
(1)	8" Adjustable Wrench (Crescent)	
(1)	10" Adjustable Wrench (Crescent)	
(1 set)	Open-End -- Box-End Wrenches	
(6)	12" Single-Cut Flat Files	
(2)	12" Single-Cut Round Files	
(2)	12" Single-Cut Square Files	
(6)	12" Single-Cut Half Round Files	
(6)	12" Double Cut Flat Files	
(2)	12" Double Cut Round Files	
(2)	12" Double Cut Square Files	
(6)	12" Double Cut Half Round Files	
(5)	Adjustable Frame Hacksaws	
(2 sets)	Flat Chisels	

UNIT INVENTORY - UNIT III
(Continued)

Basic	Supplementary

Equipment

(1) Power Hacksaw
(1) Band Saw
(2) 3/8" Hand Drill
(1) Drill Press
(1) Jig Saw
(2) 6" Bench Grinder
(8) Metal Working Bench Vise

Supplies

(2) Medium Grit Grinding Wheels
(2) Fine Grit Grinding Wheels
(1) Drill Bit set-in 1/16"

UNIT IV LAYOUT 8 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify, describe, and use the given layout tools.	A. Tools and Uses 1. steel rules 2. scriber 3. squares a. combination b. adjustable c. solid 4. calipers a. hermaphrodite b. inside c. outside 5. dividers 6. trammel 7. protractor 8. surface gauge 9. layout fluid 10. punches a. prick 60° b. center 90° 11. v-blocks	List and describe each tool and its use in student handbook Name and describe function of tools on display and explain safety rules pertaining to each.	Lecture - Display - Discussion Demonstrate the proper and safe use of all layout tools available in your shop. Filmstrip: if available in your area. Bulletin board of tools pictures.	1) pp.35-43 2) Cp.6, pp.1-10 3) pp.127-163 4) pp.59-70
The student will be able to scribe lines, arcs, circles, angles accurately as required by instructor	B. Procedures and Techniques	Make a small layout problem given by teacher (Problem to include: lines, arcs, circles, and angles) (See example in Appendix*)	Explain the basic procedure and techniques to be used in layout work. (See attached sheet in Appendix*)	Appendix
The student will be able to transport and use layout tools safely.	C. Safety 1. sharp tool care 2. material handling	Test number 2. Units II, III, and IV *Put appendix page number here when booklet is finished.		

UNIT INVENTORY - UNIT IV

LAYOUT

Basic		Supplementary
	Tools	
(10)	12" Steel Rule	(1) Surface Gauge
(1)	Metric Rule	(1) Steel Straight Edge
(1)	Decimal Rule	(1) Universal Bevel
(5)	6" Scribers	
(5)	Combination Squares	
(1)	Solid Squares	
(2)	Inside Calipers	
(2)	Outside Calipers	
(1)	Hermaphrodite Calipers	
(5)	Dividers	
(1)	Trammel Points	
(1)	Steel Protractor	
(5)	Center Punch	
(5)	Prick Punch	

Equipment

Supplies

(10) Cans Layout Fluid

(1) Roll of Butcher Paper and Holder

UNIT V BENCH METALWORK 13 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify and describe the use of each of the hand cutting tools safely.	A. Hand Cutting Processes 1. saws a. hacksaw (1) blade selection (2) safety	List and describe each tool and its use in student notebook. Name and describe function of tools on display and explain safety rules pertaining to each by sight.	Lecture - Display and discussion for all tools with demonstration of each with a hand hacksaw. Demonstrate the correct stance and cutting procedure. Demonstrate the correct way to clamp various shapes of metals in a vise to be cut.	1) p.53 2) Cp.9, pp.1-5 3) Cp.1,p.79 4) pp.71-72
	2. chisels a. types (1) flat (2) cape (3) round hose (4) diamond point b. uses (1) cutting (2) shearing (3) chipping c. safety	The practical use of each tool will occur when the student is constructing the project.	Explain correct usage and sharpening procedures for a chisel.	1) p.53 2) cp.8,pp.1-7 3) pp.185-187 4) pp.73-75
	3. files a. classification (1) single-cut (2) double-cut (3) rasp (4) curved-tooth b. shapes (1) flat (2) square (3) half-round (4) round c. uses (1) cut (2) smooth (3) fit parts together d. safety		With a file draw file a piece of metal stock to show the correct procedure and stance. Draw a pictorial drawing depicting the different shapes, types and cuts of files. Filmstrip: if available in your area.	1) pp.51,52 2) cp.17,pp.1-7 3) pp.185-187 4) pp.73-75

UNIT V BENCH METALWORK (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to determine the difference between natural and artificial abrasives.	4. abrasives a. classification (1) natural (a) emery (b) garnet (c) diamond (2) artificial (man made) (a) silicon carbide (b) aluminum oxide (c) boron carbide b. safety	Have each student bring in different types of abrasives from their home shop and make a class display board.	Use charts, displays, and samples of natural and artificial abrasives.	1) pp.103-106 2) cp.14,pp.1-3 3) 4) pp.317-329
	B. Power Cutting Process 1. saws a. power hacksaw b. band saw c. abrasive cut-off saw d. safety		Demonstrate the proper way to clamp metal on the power hacksaw and abrasive cut-off saw. Develop maintenance procedures for each machine.	1) pp.55-57 2) Cp.35,pp.1-5 3) pp.181-183 4) pp.101-105
	2. Grinders a. bench b. portable c. pedestal d. safety		Demonstrate how to remove and re-install correctly the blades and bits on the various machines.	1) p.140 2) cp.33,pp.1-15 3) pp.204-208 4) pp.331-335
	3. drills and drilling machines a. types of drills (1) straight flute (2) twist drill b. sizes (1) numbered (2) lettered (3) fractions (4) drill gauge			1) pp.57-58 2) cp.34,pp.1-23 3) pp.248-259 4) pp.115-125
	c. holding device (1) vise (2) v-block d. drilling machines (1) portable (2) drill press 3. safety		Demonstrate the proper way to clamp pieces to be drilled using vise and v-blocks.	

UNIT V BENCH METALWORK (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify, describe, and use each of the striking tools safely.	C. Striking Tools 1. machinist's hammer (ball peen) 2. soft faced hammer a. plastic b. rubber c. rawhide d. lead 3. safety	Set up nail board to find out the difference of each hammer when driving a nail.	Show and explain the various soft faced hammers in shop. Hit a piece of soft metal (copper) with a machinist hammer and a soft face hammer. Pass around the two pieces of metal and explain why and when you should use each type of hammer.	1) pp.95-96,48 2) cp.7,pp.1-2 3) 4) pp.70-71
The student will be able to identify thread types, thread tools by sight.	D. Threading 1. types of threads a. American National Thread System b. National Coarse (NC) c. National Fine (NF) 2. Internal Threading a. taps (1) taper (2) plug (3) bottoming b. holding device (1) T-handle (2) tap wrench 3. external threads a. dies (1) solid (2) adjustable round (3) two-piece adjustable b. holding device (1) die stock 4. safety		Explain the correct procedure for reading a tapping and die chart. Demonstrate the correct step-by-step method for cutting internal and external threads.	1) pp.60-64 2) cp.11,pp.1-8 3) 4) pp.76-79

UNIT V BENCH METALWORK (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to use the various clamping devices.	E. Clamping 1. vises 2. clamps a. c-clamps b. vise grips 3. protective caps a. wood b. copper c. sheet metal 4. safety		Lecture - Display and discussion for all tools with demonstration of each. Show how to make and use protective caps and why they are valuable to the metal worker in protecting the finish. (Clamp small piece of aluminum in a vise without jaw caps. Clamp another piece of aluminum in vise with jaw caps. Pass around both pieces and let students see what happens.)	1) p.48 2) cp.13,pp.1-2 3) 4) pp.70,224
The student should be able to list and use the various adjustable and non-adjustable wrenches with proper safety.	F. Tightening 1. wrenches a. adjustable (1) pipe (2) crescent (3) slip-joint pliers (4) channel-locks b. non-adjustable (1) open end (2) box end (3) sockets (4) spanner		Explain and demonstrate the proper way to use each wrench available in your shop.	1) pp.50-51 2) cp.15, pp.1-5 3) 4)
The student should be able to identify the various screwdrivers and use them safely.	2. screwdrivers a. standard b. phillips head 3. safety		Demonstrate the proper way to grind a standard screwdriver tip.	1) p.49 2) cp.16,pp.1-3 3) 4) p.71

UNIT V BENCH METALWORK (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify, explain, and demonstrate the proper and safe use of the fastening device.	G. Fastening 1. screws a. machine (1) round head (2) oval head (3) flat head (4) others b. cap screws c. set screws d. self tapping screws (sheet metal) e. thread cutting 2. bolts a. machine b. stud 3. nuts a. hex nut b. square nut c. wing nut d. cap nut 4. rivets a. types (1) button head (2) counter sunk (3) flat head (4) pan head (5) blind rivet (pop rivet b. setting a rivet	Make up a display board of different types of fasteners. List and describe each fastener and its use in student notebook. Test # 3 - Unit 5	Have students make a display board of the different types of fasteners	1) pp.75-79 2) cp.18,pp.1-7 3) pp.456-570 4)

UNIT INVENTORY - UNIT V

BENCH METALWORK

Basic

Tools

(1) Needle Nose Plier
(2) Diagonal Cutting Plier
(2) Groove Joint Pliers (Channel Lock)
(1) Wire Cutting Plier
(2) 14" Pipe Wrench
(1) 3/8" Socket Set
(1) 6" Cape Chisel
(1) 6" Round Nose Chisel
(1) 6" Diamond Point Chisel
(1) Tap and Die Set
(2) 6" C-Clamp
(2) 8" C-Clamp
(2) 10" C-Clamp
(2) 6" Standard Vise Grip
(4) 8" Standard Vise Grip
(2) 10" Standard Vise Grip

Equipment

(1) Drill Press Vise
(1) V-Block Set
(3) Clear Face Shields
(25) Safety Glasses or Goggles

Supplies

(10) Power Hack Saw Blades 14 Teeth Per Inch
(30) Hand Hacksaw Blaces 18 Teeth Per Inch
(1) Roll Natural Abrasive (Sandpaper) 100 Grit
(1) Roll Artificial Abrasive (Sandpaper) 150 Grit

Various Assortment of:
Machine screws, cap screws, bolts, nuts, washers, rivets

(1) Countersink

Steel (Various Sizes and Shapes of Hot Rolled)

Supplementary

Tools

(1) Lineman's Pliers
(1) Parallel Clamp
(1) Offset Screwdriver
(1) Spiral Ratchet Screwdriver
(1) Thread Gauge
(1) Single Cut 3 Square File
(1) Double Cut 3 Square File
(1) File Card

Equipment

(1) Pedestal Grinder
(1) Step Blocks
(1) Drill Bit Sharpening Attachment
(1) 1/2" Hand Drill
(1) Drill Size Gauge

UNIT VI SHEET METAL 8 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify and perform the different pattern making developments.	A. Pattern Making 1. parallel line development a. prisms b. cylinders 2. radial line development a. cones b. pyramids	List and describe each pattern making procedure in notebook. Make simple parallel and radial line development on paper.	Lecture - Discussion for all procedures and tools with demonstration of each. Unfold an empty cereal box.to explain surface development	1) pp.80-85 2) cp.19,pp.1-5 3) 4)
The student will be able to identify, describe the use of each of the sheet metal hand tools safely.	B. Hand Tools 1. hand snips a. circular b. straight c. aviation 2. punches a. hollow b. solid 3. sheet metal gauge 4. hammers a. riveting b. setting c. mallet 5. hand seamer 6. hand groover 7. soldering copper 8. safety	List and describe each tool and its use in student notebook The practical use of each tool will occur when the student is constructing the project.	Filmstrip: if available in your area. Show how to properly use the soldering copper. Demonstrate the proper step-by-step procedure in tinning a soldering copper	1) pp. 86-93 2) cp.19,pp.5-7 3) 4) pp.59-64
The student will be able to identify, describe the use each of the floor machines and equipment safely in performing all their basic operations.	C. Floor Machines and Equipment 1. machines a. squaring shear b. bar folder c. box and pan brake d. slip roll forming machine e. combination rotary machine f. notcher g. portable power shears	List and describe each machine and its use in student notebook. Name and describe the function of each machine on display and explain the safety rules pertaining to each. The practical use of each machine will occur when the student is constructing the project	Lecture - Display and discussion for all machines with demonstration of each. Assemble students around each machine for discussion of operational procedures, safety procedures, etc.	1) pp.86-93 2) cp.19,pp.7-14 3) 4)

VI. SHEET METAL (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	2. equipment a. universal stake holder b. stakes c. bench shear 3. safety		Demonstrate shaping operation for each stake.	
The student will be able to safely demonstrate the proper bending and shaping operations.	D. Bending and Shaping Operations 1. hems a. single b. double 2. edges a. wired b. burr c. crimped 3. seams a. lap b. flat lock groove c. double seam d. corner seam 4. safety	List and describe each operation and its use in student notebook. The practical use of bending operations will occur when the student is constructing the project.	Lecture - Display and discussion for all operations with demonstration of each. Make a large scale model of the most common sheet metal joints.	1) pp.88-90 2) cp.19,pp.14-19 3) 4)
The student will be able to use each of the fastening methods and apply them to the selected project safely.	E. Sheet Metal Fastening 1. riveting 2. screwing 3. soldering a. flux b. solder 4. spot welder 5. safety	The practical use of fastening will occur when the student is constructing the project. Test number 4 Unit VI	Demonstrate the correct procedure in the use of spot welder. Outside speaker from sheet metal shop to explain the type of industry. Invite a guest speaker to your class to speak on the topic of sheet metal. Make chart to show work assignments with sheet metal	1) pp.75-76,131 2) cp.19,p.19 3) p.374 4)

UNIT INVENTORY - UNIT VI

SHEET METAL

Basic

Tools

(5) Riveting Hammer
(1 set) Hollow Punch
(2) Circular Pattern Snips
(5) Straight Pattern Snips
(3) Left Aviation Snips
(3) Right Aviation Snips
(3) Straight Aviation Snips
(2) Hand Seamers
(2) Hand Groovers
(3) Soldering Coppers
(2) Hand Notcher (45 and 90 Degree)
(1) Sheet Metal Gauge
(1 set) Rivet Sets

Supplementary

(1 set) Solid Punches

Equipment

(1) Squaring Shear (Foot Powered)
(1) Bar Folder
(1) Box and Pan Brake
(1) Slip Roll Forming Machine
(1) Portable Hand Power Shears
(1) Bench Plate and Stake Set
(1) Bending Jig (DI-Acro or Universal)
(1) Gas Fired Soldering Furnace
(1) Hand Power cutting sheet Metal Shears
(1) Propane Bunson Burner Kit

(1) Combination Rotary Machine
(1) Combination Notcher

Supplies

(2) 4' x 8' 16-Gauge Hot Rolled Sheet
(2) 4' x 8' 22-Gauge Galvanized Sheet
(4) 4' x 8' 24-Gauge Galvanized Sheet
(5) Rolls of 50-50 Solder (Solid Core)
(5) Cans Soldering Flux (Paste)
(1) Block Sal Ammoniac

UNIT VII ART METAL 3 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to use and identify art metal tools safely.	A. Tools 1. Jeweler's saw 2. Jeweler's file 3. wood block 4. mushroom stake 5. sand bag 6. hammers a. planishing b. forming c. raising	List and describe each tool and its operation in student notebook.	Invite a local jeweler to come and demonstrate the basic techniques used in art metal.	1) pp.94-102 2) cp.20,pp.1-13 3) 4)
The student will develop skills to perform art metal operations.	B. Sawing and Piercing C. Raising D. Chasing E. Beating Down F. Planishing	The practical use of art metal operations will occur when the student is constructing the project		

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UNIT INVENTORY - UNIT VII

ART METAL

Basic	Supplementary
Tools	
(5) Planishing Hammers	(1) Snarling Iron
(5) Jewelers Saw	(1) Raising Hammer
(3 sets) Jewelers Files	(1) Forming Hammer
	(1 Set) Jewelers Screwdrivers
Equipment	
	(1) Small Swivel-Base Bench Vise
	(1) Soldering Gun
Supplies	
(10) #10 Jewelers Saw Blades	(1) 2' x 2' Brass Sheet
(10) #4 Jewelers Saw Blades	(1) 2' x 2' Copper Sheet
(5) Sand Bags	

UNIT VIII ORNAMENTAL METALWORK (WROUGHT METAL) 4 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify and demonstrate the safe and proper use of ornamental metalworking tools and machines. The student will be able to perform the various types of bends used in ornamental metalworking.	A. Hand Bending 1. tools a. vise b. hammer c. monkey wrench d. bending jig 2. types of bends a. angle b. twist c. scroll d. circle 3. safety B. Machine Bending 1. Di-Acro bender 2. universal bender 3. metal former 4. Hossfeld scroll bender 5. safety	List and describe each tool and operation in student notebook. The practical use of ornamental metalwork tools and machines will occur when the student is constructing the project. Test number 5 Units: VII and VIII	Film strip if available in your area. Using a pipe wrench demonstrate how to twist a piece of square stock and band iron in a bench vise. Make a display board of the different types of scrolls Using the various attachments set up bending machine to make the following bends: circles, eyes, angles and scrolls.	1) pp.66-70 2) cp.27,pp.1-4 3) 4) 1) pp.70-74 2) cp.27,pp.6-17 3) 4)

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UNIT INVENTORY - UNIT VIII

ORNAMENTAL METALWORK

Basic	Supplementary
Tools	
	(1) Monkey Wrench
Equipment	
(1) Di-Acro Bending Machine with accessories	(1) Hossfeld Scroll Bender
(1) Bending Jig	(1) Rod Parter
Supplies	
Various types and Sizes of Hot Rolled Steel	

UNIT IX FORGING 4 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify and use safely all hand forging tools.	A. Hand Forging Tools 1. anvil 2. tongs a. straight lip b. curved lip c. pick up 3. hammers a. sledge b cross peen c. ball peen 4. safety	List and describe each tool and technique used in forging in student notebook.	Filmstrip: If available in your area.	1) pp.107-111 2) cp.28,pp.1-6 3) 4)
		The practical use of forging tools, techniques and safety will occur when the student is constructing the project.	Demonstrate the safe procedures to properly ignite and turn off the furnace	
	B. Machine Forging		Find pictures in books showing machine forging processes.	
The student will be able to safely demonstrate the basic hand forging techniques.	C. Hand Forging Techniques 1. upsetting 2. bending 3. drawing out 4. safety		Show the use of different parts of the anvil	
The student will be able to demonstrate the safe procedure for lighting the furnace.	D. Furnace 1. lighting 2. operation 3. shut down 4. safety			
The student will be able to explain the types of heat treating processes.	E. Heat Treating 1. Types a. annealing b. case hardening c. tempering d. hardening 2. temperature control by color 3. safety		Show examples of what happens when metals are over heated.	1) pp. 133-136 2) cp.31,pp.1-8 3) pp.419-428 4) pp.402-406

UNIT INVENTORY - UNIT IX

FORGING

Basic

Tools

(2) Hand Sledge Hammers
(1) Straight Lip Tongs
(1) Curved Lip Tongs
(1) Pick-Up Tongs

Equipment

(1) Anvil

Supplies

Various Types and Sizes of Hot Rolled Steel

Supplementary

Tools

(1) Flatter Hammer
(1) Cross-Peen Hammer
(1) Forging Punch Hammer
(1) Forging Chisel Hammer

UNIT X METAL CASTING 5 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The students will be able to explain and identify the types of patterns.	A. Sand Casting 1. patterns a. simple (one piece) b. split (1) positive draft (2) negative draft	Have a student make a one piece pattern.	Show the difference between positive and negative draft.	1) pp.114-124 2) cp.21,pp.1-14 3) pp.299-314 4)
The student will be able to identify terms and tools used in the foundry area.	2. tools a. flask b. sprue and riser c. ram d. bottom board e. riddle f. strike off bar g. lifter,slick and oval		Visit the local foundry in your area. Filmstrip: if available in your area.	
The student will be able to recognize sand that is properly tempered.	3. molding sand a. tempering sand	Have student show how to temper the molding sand.	Demonstrate and explain the step-by-step operational procedures of sand casting.	
The student will be able to light, adjust and shut down furnace.	4. Furnace equipment a. crucible furnace b. tongs c. crucible			
	5. safety		Pour some hot metal on an old tennis shoe to demonstrate the need in wearing proper and safe protective clothing.	
The students will be exposed to the other industrial types of casting.	B. Other Types of Casting 1. shell mold 2. investment 3. permanent 4. die casting		Display models of different types of casting.	1) pp.112-114 2) Unit 22-26 3) pp.315-324 4)
		Test number 6. Units IX and X.		

UNIT INVENTORY - UNIT X

METAL CASTING

Basic	Supplementary
Tools	
(1) Sprue and Riser Pins	(1) Shrink Rule
(1) Rammer	(1) Draw Screw
(2) Molding Board	(1) Molder's Bellows
(1) Riddle	(1) Trowel
(1) Strike Off Bar	(1) Gate Cutter
(1) Lifter Tool	(1) Sprinkling Can
(1) Slick and Oval	
(1) Bulb Sponge	
(1) Crucible Tongs	
(1) Vent Wire	
(1) Shovel	
Equipment	
(1) Crucible Furnace	(1) Immersion-Type Pyrometer
(1) Crucible	
Supplies	
(50 lbs.) Molding Sand	(1 set) Standard Patterns
(2) Parting Compound 1 lb. can	
(8 Ingots) Aluminum	
(4 Ingots) Lead	

UNIT XI WELDING 10 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify the gas welding equipment and accessories. The student will be able to demonstrate how to assemble the equipment correctly and safely. The student will be able to light and adjust torch to properly gas weld, cut and braze.	A. Gas 1. Tools and equipment a. oxygen and acetylene cylinders b. regulators c. hoses d. torch e. tips: cutting,welding heating f. striker g. goggles and gloves h. flux and filler rod 2. setting up equipment 3. lighting torch 4. adjusting equipment 5. gas operations a. welding b. cutting c. brazing 6 safety	Have student light torch and adjust to the three basic flame. Practice cutting holes and straight cuts	Perform the different methods of adjusting the gas torch to achieve the 3 different types of flames. With the aid of gas filled balloons demonstrate gas properites: with balloons Fill 1 balloon with oxygen to 6" diameter. Fill 1 balloon with acetylene to 3" diameter. Fill 1 balloon with ½ oxygen and 1/2 acetylene to 1½" diameter. Light each individually to note differences of gases and combinations.	1) pp.128-131 2) cp.30,pp.1-8 3) pp.385-392 4)

UNIT XI WELDING (Continued)

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to identify the tools and equipment needed for arc welding.	B. Arc Welding 1. tools and equipment a. arc welding machine b. helmet and gloves c. chipping hammer d. wire brush e. electrodes f. protective clothing		Explain the different welding equipment to the class and explain the use of each.	1) pp.125-128 2) cp.30,pp.8-18 3) pp.329-350 4)
The student will be able to set up the equipment and adjust the amperage.	2. setting up equipment			
The student will be able to strike and maintain arc with proper arc length and electrode angle; in the flat position.	3. striking an arc			
	4. welding in flat position	Have students practice plate welding running beads in flat position.	Make basic welding joints for demonstration. These can be made of metal or wood.	
	5. safety	Have students design a safety poster on welding.	Make two welding plates depicting normal welds and improper welds to be used as teaching aids.	

UNIT INVENTORY - UNIT XI

WELDING

Basic	Supplementary

Tools

(3) Chipping Hammers
(2) Framing Squares

Equipment

(1) 7" Hand Grinder
(2) A.C. Arc Welder
(1) Oxyacetylene Welding Outfit
(Hoses, Regulators, Torch, etc.)
(3) Gas Welding Goggles
(3) Arc Welding Helmets
(1) #0 Torch Tip
(1) #2 Torch Tip
(2) #2 Cutting Tip
(1) Striker

(1) Heating Tip

Supplies

(2) 50# Boxes 1/8" E-6013 Electrodes
(2) 50# Boxes 1/8" E-7014 Electrodes
(10 lbs.) 3/32" Brazing Rod
(15 lbs.) 3/32" Mild Steel Welding Rod
(1 can) Brazing Flux
(3) Wire Brushes
(6 sets) Leather Gloves
(1) Medium Bottle of Oxygen
(1) Medium Bottle of Acetylene
(1) Welding Tank Cart
(1 set) Torch Tip Cleaner
(4) 1/8" Plate Steel 4' x 8' sheets

UNIT XII METAL FINISHING 2 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to explain the types of hand and machine finishes.	A. Hand and Machine Finishing 1. brushing 2. sanding 3. polishing 4. buffing 5. painting 6. spraying 7. dipping	To finish their project with one of the different types of finishing Test number 7. Units: XI and Xii	Display samples of a metal finished by each of the finishing methods. Filmstrip: if available in your area. Using aerosol and airless spray gun demonstrate the proper method in spray painting.	1) pp.103-106 2) cp.32,pp.1-5 3) p.472 4)

UNIT INVENTORY - UNIT XII

METAL FINISHING

Basic

Supplementary

Tools

Equipment

Supplies

(1 Doz.) 1" Paint Brushes
(2) 6" Buffing Wheels
(2) 6" Wire Wheels
(1) Block Tripoli
(1) Block Pumice

UNIT XIII PLANNING 13 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to read a working drawing.	A. Review of Working Drawings 1. assmebly drawing 2. detail drawing a. dimensions b. views		Bulletin board display of different blue prints and drawing from industry.	1) pp.24-30 2) Unit 2 3) 4)
The student will be able to apply the principles of design in the project drawing.	B. Basic Principles of Design and Construction 1. lines 2. proportion 3. balance 4. emphasis 5. texture 6. color	Have students design a metal shop award.		
The student will be able to read a standard and metric rule.	C. Review of Measurement and Shop Mathematics 1. reading a rule review a. 12: rule to 1/16" b. metric:1 meter-1m.m. 2. shop math review		Quick quiz on reading a rule. If available have students tour drafting class to observe machine drawings	1) p.46 2) cp.4,pp.1-4 3) 4) pp.8-10
The student will be able to make a working drawing of his project from a picture or replica.	D. Individual Project Drawing 1. selection of project 2. rough sketch 3. teacher's evaluation of sketch 4. final drawing (working)	Have students gather items from magazines, newspapers, etc. Make rough sketch of project to be made.	Evaluate all project sketches and make all corrections to be made. Show pictures of previous projects built.	1) pp.19-23 2) 3) 4)
The student will be able to fill in a bill of material from a drawing of a project.	E. Bill of Material 1. part number 2. number of pieces (quantity) 3. part name 4. material 5. size: T,W,L 6. unit cost 7. total cost	Have student fill out bill of material sheet after finishing drawing.	-Develop a handout sheet showing bill of material format. Show student how to set up a bill of material.	
The student will be able to design a plan of procedure for each project.	F. Plan of Procedure 1. operations (list) 2. tools (list) 3. equipment (list)	Have student fill out a plan of procedure listing all tools, procedures with relation to his drawing and bill of material.	Develop a hand out sheet showing the plan of procedure format.	

UNIT XIV CAREERS IN METALWORKING 2 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to recall the various careers relating to metals. The students will be exposed to the variety of ways to obtain employment in the metals industry.	A. Levels of Skill 1. semiskilled 2. skilled 3. technicians 4. professions B. Classifications of Occupations 1. steelworker (iron worker) 2. welder 3. tool and die maker 4. sheet metal technician 5. machinist 6. others C. Methods of Training 1. high school 2. Vo-tech school 3. college 4. apprenticeship	Have students cut out all metal-working jobs from paper. Test number 8. Units: XIII and XIV	Write a representative from the State Employment office to come and talk to students about careers in metals. Have a former student who is working in industry speak on how the class helped him.	1) pp.183-190 2) cp.50,pp.1-7 3) 4)

UNIT XV SAFETY 2 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be able to recall all information pertaining to safety from the past units, (tools machines, processes and techniques)	A. Review Safety on All Units	Have student design and make a safety poster concerning any of the topics covered. (14 x 18)		1) pp.31-34 2) cp.3,pp.1-3 3) pp.103-126 4) pp.5-8
The student will be required to perform above 80% on the safety test given at the end of classroom instruction.	B. Safety Test	Major Safety Examination. (Student must make 80% or better to be permitted to use equipment and tools in the lab) Test number 9. Unit XV	Develop a safety test that can be used to evaluate fully the safety knowledge of each student.	

UNIT XVI BASIC METAL PROJECTS 90 Hours

OBJECTIVES/TIME ALLOTMENT	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student will be required to construct a minimum of 4 projects of the 7 fields listed (in some cases fields will overlap) The students will demonstrate the proper and safe use of all machines, equipment, hand and power tools, materials, techniques and processes while constructing their projects.	A. Bench Metal Work B. Sheet Metal C. Art Metal D. Ornamental Ironwork E. Forging F. Casting G. Welding.	See Appendix		See: 1) Appendix 2) Resource Materials

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Suggested List of Basic Metal Classroom Rules

It is recommended that each teacher have a list of Classroom Rules to govern students' behavior. The following are rules that you may wish to use as a supplement to your list.

Introduction: Student Introduction

The following of these rules is important to you as a student. Abiding by the general classroom rules will make your classroom experience more enjoyable, safer and rewarding.

1. Comply with all reasonable requests of the teacher.

2. You as a student are required to have a pencil and notebook in class each day for notes.

3. No smart remarks to the teacher.

4. Talking is absolutely forbidden:

   Whenever the teacher is talking
   Whenever any test, examination or quiz is in progress
   Whenever any other student has the floor
   Whenever there is any king of audio-visual presentation in progress (film, filmstrip).

5. You may not leave to go to another teacher's room without a written note from that teacher and approval from your metals teacher.

6. Do not leave class without permission.

7. No loud talking at any time.

8. The tardy bell is a sign of being late. You are to be in your seat when the tardy bell rings.

9. The bell is only a signal to the teacher that class is over: you are not to leave until the room is clean and straigtened up and you are dismissed.

10. You must have an excuse for being late and for being absent. The excuse must be handed to the instructor in person to be marked excused.

11. Absence does not excuse you from any assignments. If you are ill, the back work must be done as soon as you are able.

12. The shop is not a place to play or fight.

13. No obscene language.

14. All other school rules apply here in the lab as well: no gum, candy, soft drinks, or any form of tobacco.

15. The shop office is off limits.

16. Do not answer the office phone unless told to do so by the instructor.

17. Do not leave paper, trash, etc. in the desks or on the floor.

18. No marking or otherwise defacing school properly. This includes desks, floors, walls, chairs, books, etc.

19. Enter and exit through the front door only.

20. When the outside door is open you are not to stand in it, nor are you to talk to someone outside.

21. Do not go into the tool room or stock room unless told to by the teacher or you are assigned to that area.

22. Wearing the proper safety equipment is a must. This will be discussed in full later.

23. Do not play with tools and do not use them until you have been instructed on their proper use.

24. Start work only when the teacher tells you.

25. You will be given 10 minutes at the end of each hour to clean-up and put away your materials (only 10 minutes).

26. When you have a clean-up job to do, do it without complaint or fuss.

27. If you take (steal), or break an item or tool on purpose you must pay for it or replace it.

28. Full credit is given only for work handed in exactly on due date.

29. If for any reason you are failing or falling behind, you must attack this problem in a systematic way.
    A. Confer with your teacher. Get his recommendations.
    B. Report the matter to your parents promptly.

30. Accept helpful criticism gracefully. Remember that your behavior reflects you.

Suggested General Safety Rules

It is recommended that each teacher have a list of general safety rules. The following are rules you may wish to use as a supplement to your list.

Introduction:

"Ignorance of the law excuses no one." Ignorance of this information will not be accepted as an excuse. Keep these sheets in your folder at all times. You must master their content and follow it. This will make your classroom experience more enjoyable, safer, and rewarding.

1. Wear eye protection at all times in the lab.
2. Beware of blunt tools.
3. Avoid loose fitting clothes.
4. The lab is a place to work not play.
5. Tricks and prnaks are dangerous to you and your friends.
6. Don't be responsible for sending a student to the hospital by playing a joke.
7. Choose the right tool for the right job.
8. Never carry sharp tools in your pocket.
9. Clean oil and grease off all hand and power tools before and after using them.
10. Make sure all electrical cords and plugs are not broken or cracked.
11. Keep all electrical cords away from oil and hot surfaces.
12. Never allow anyone to stand near the machine while in use.
13. Keep all guards in place.
14. Operate a machine only after you have knowledge of how to use it properly.
15. Do your job in keeping the shop clean and orderly.
16. Clean each machine after using it.
17. Put away tools after using them.
18. Dispose of all waste materials properly.

19. Put your material away at the end of the classroom period.

20. A clean lab is a safe lab.

21. Never clean away chips with your hand.

22. Projects should be stored in an assigned area.

23. Keep aisles clean.

24. Ask for first aid when needed.

25. Report all accidents to the instructor.

26. Dress properly.

27. Know your job and do it correctly.

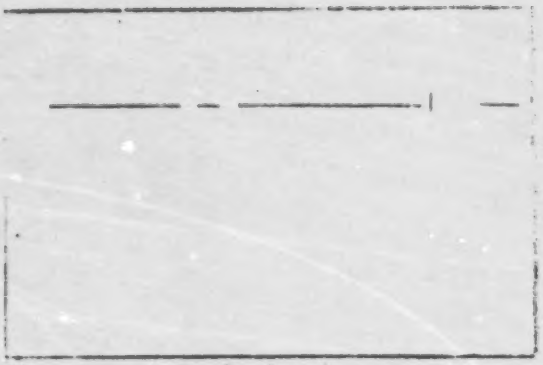


Fig. 1 a. Study drawing
b. Cut stock to size remove burrs
c. Clean workpiece apply layout fluid
d. Locate and scribe base line. Make all measurements from this line.

Fig. 2 a. Locate the center points
b. Use prick punch to make the centers
c. Enlarge with center punch

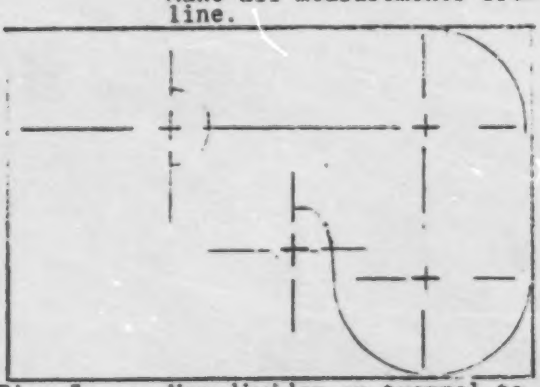


Fig. 3. a. Use divider or trammel to scribe circles and arcs.

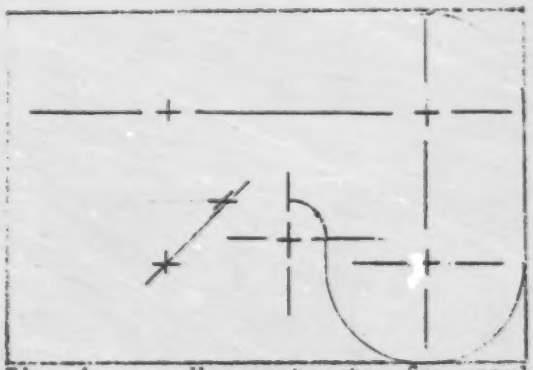


Fig. 4. a. Use protractor for angular lines

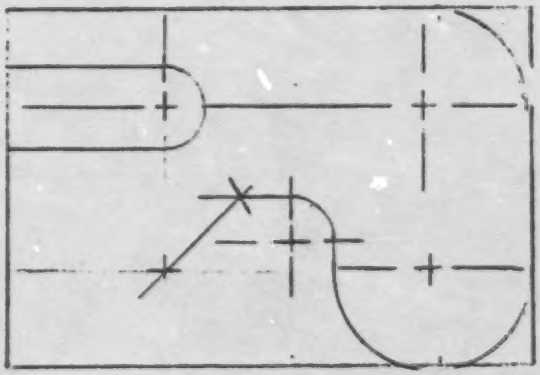


Fig. 5 a. Scribe all other internal openings.

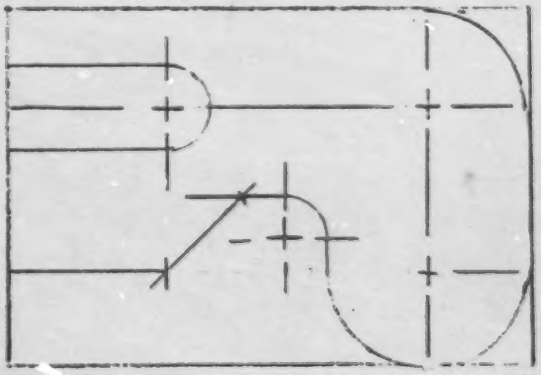
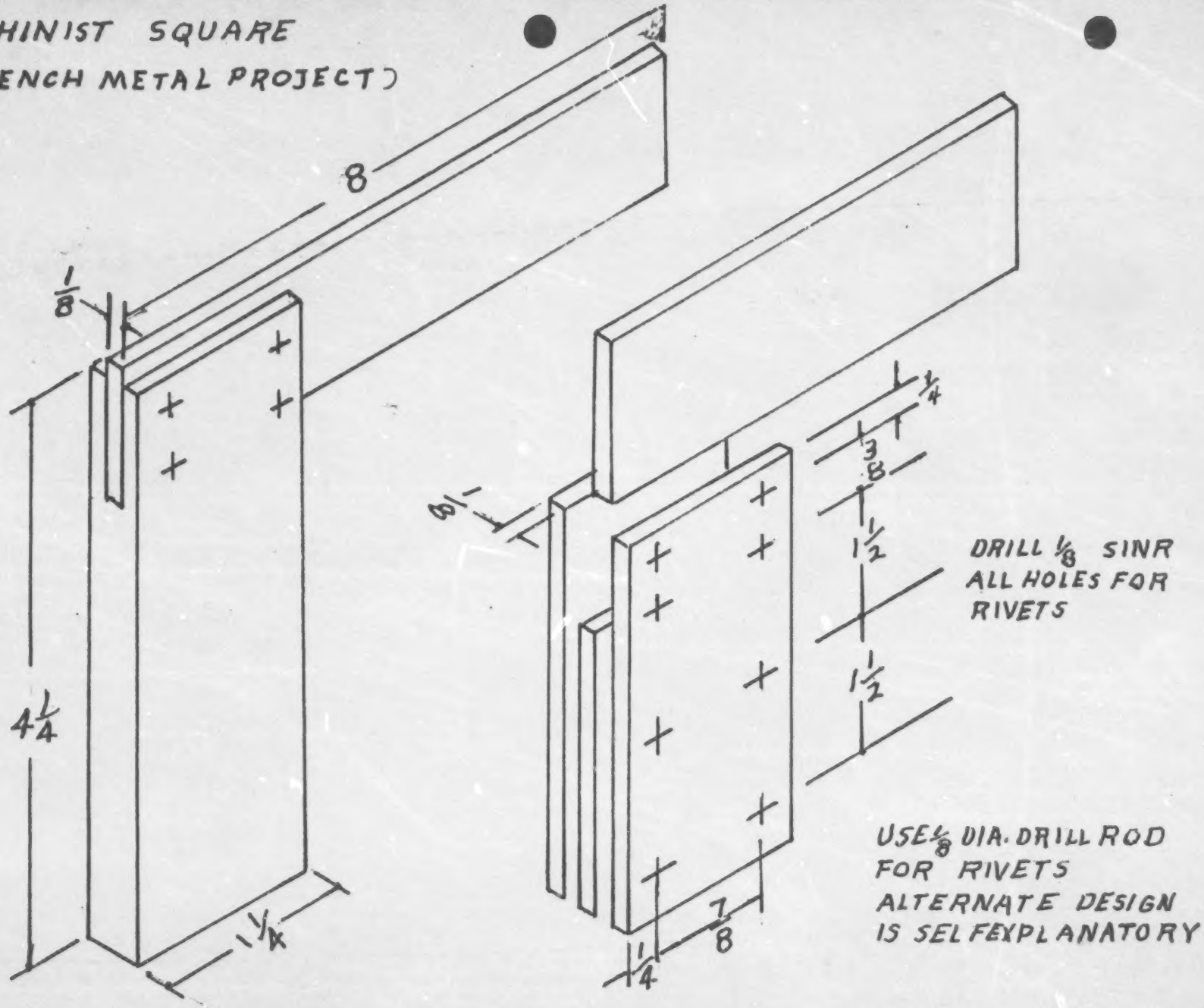


Fig. 6. a. Use only clean sharp lines. Recoat lines with dye if wrong.

BENCH METAL PROJECTS

	Book Number	Page Numbers
Pin-Up Lamp	19	423
Spice Rack	19	422
Bottle Opener	19	417
Magazine Rack	12	17
	12	18, 20
Chow Time Chime (Dinner Bell)		
Candle Holder	10	5
Trivet	18	442
	10	10, 32
Tic-Tac-Toe Game		
Pencil Holder		
Garden Trowel		
Book Holder	18	438
	12	11
Screen Door Guard	12	66
Cooking Pan Drainer	12	72
Yard Sign		
Barbecue Tools	10	86
	17	47
Plant Holder	18	458

MACHINIST SQUARE
(BENCH METAL PROJECT)



ALTERNATE DESIGN

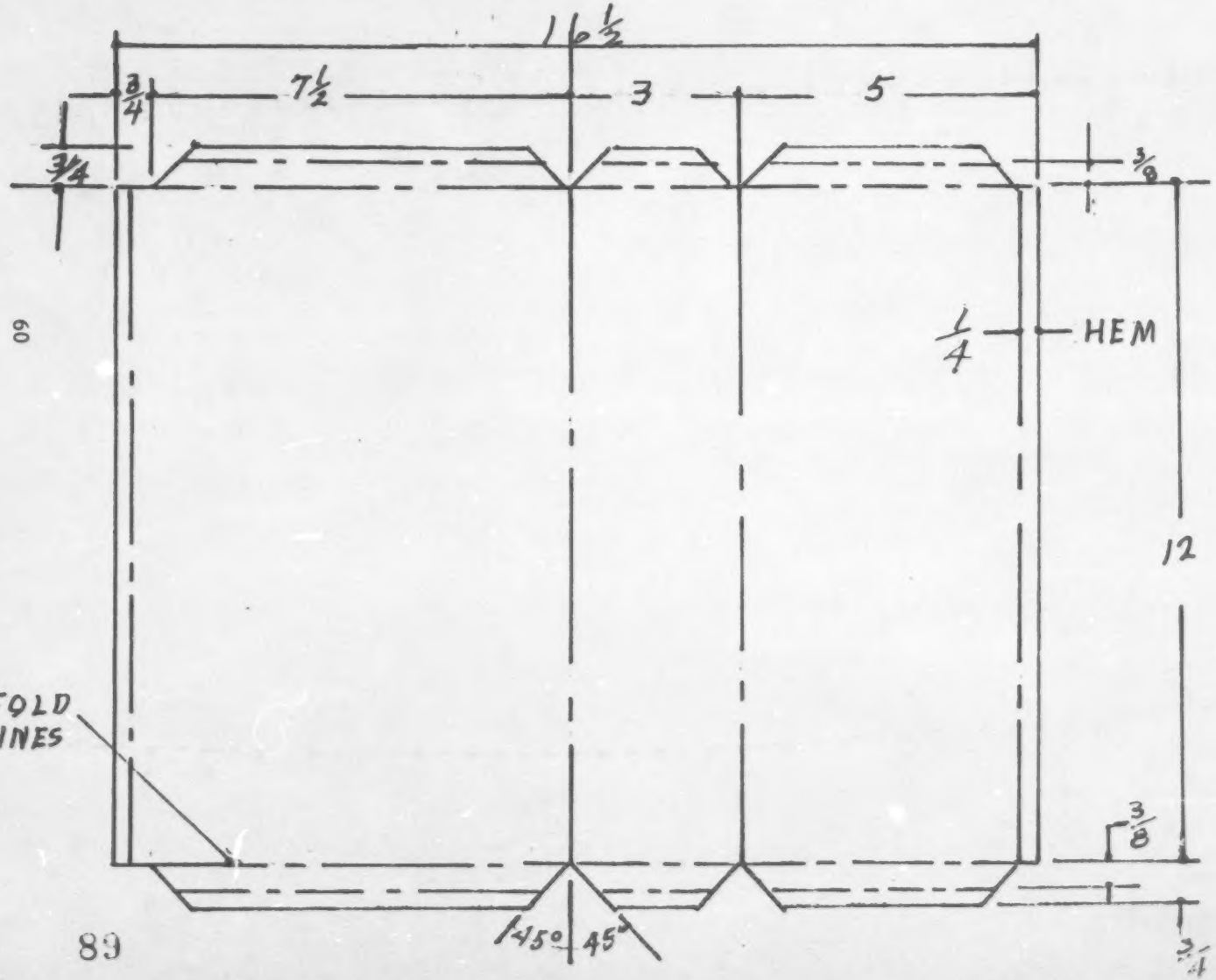
SHEET METAL PROJECTS

	Book Number	Page Numbers
Mailbox	10	62
	17	21, 34
	12	49
	19	466
Charcoal Hop	19	425
Planter	18	450
	10	16
	12	9
	19	420
Tool Tray	17	40
Bird Feeder	18	445
	10	8, 9
	7	99
Waste Basket	18	448
	10	60
	12	22
Outdoor Post Lantern	18	447, 446
	17	29
	16	141
Candle Molds		
Cup	10	59
Pierced Lantern	13	70-72, 88
Fishing Tackle Box	7	100
Sconce	10	14
Coal Scoop	10	44
Coat Hanger	10	80
Wood Holder	10	83
	17	38
	12	40

DUST PAN

SHEET METAL PROJECT

SHEET J



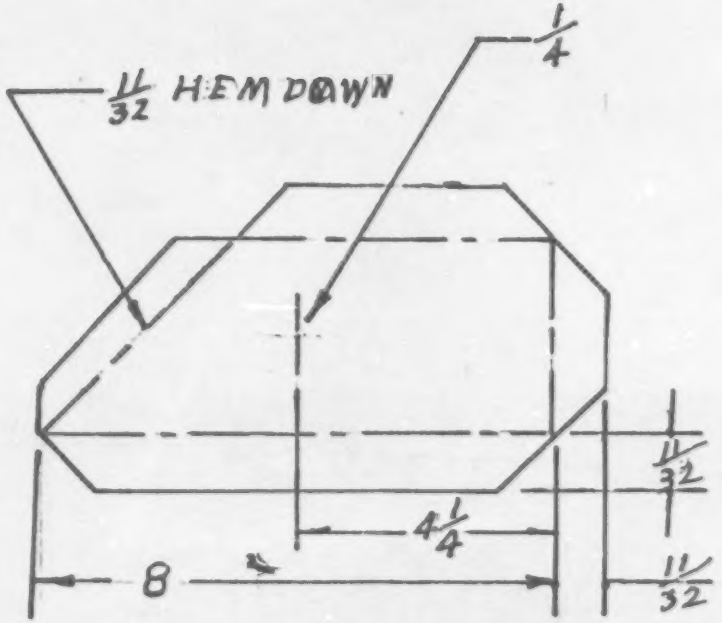
PAN

89

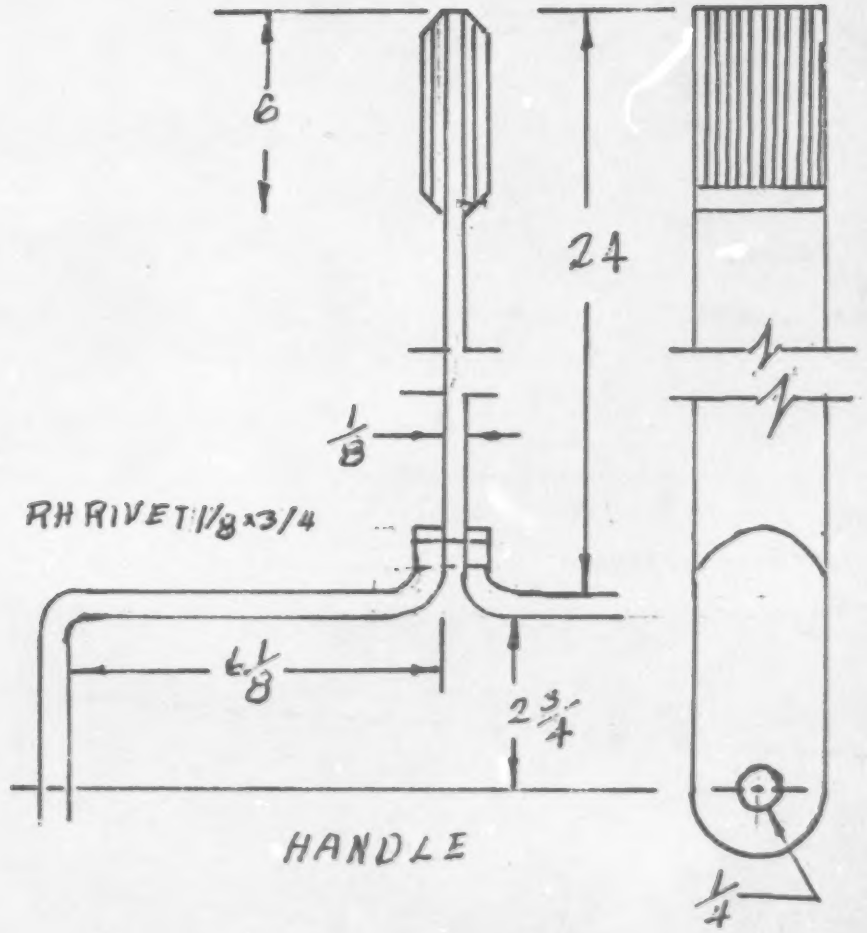
90

DUST PAN

SHEET II



SIDE 2 REQUIRED



HANDLE

ART METAL PROJECTS

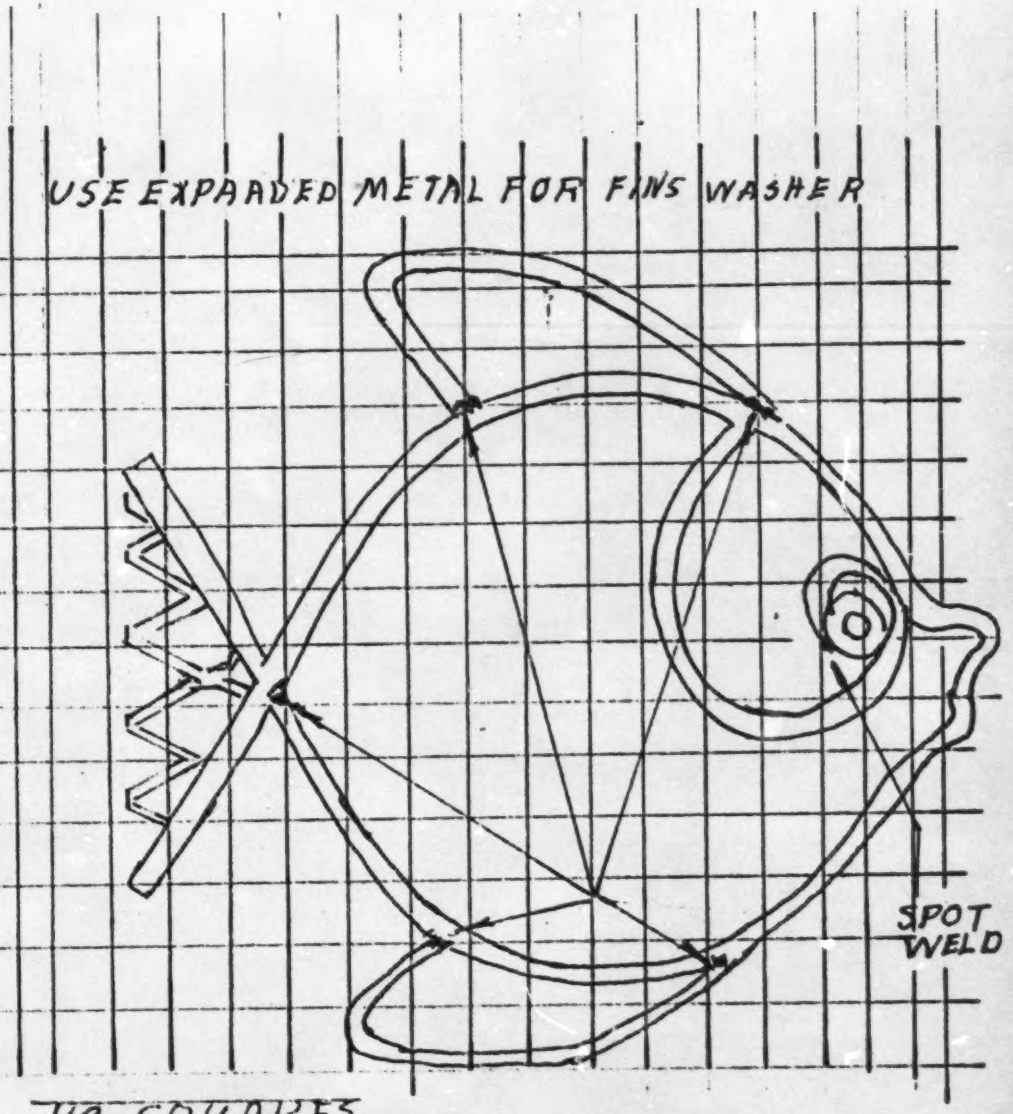
	Book Number	Page Numbers
Wall Plaque	12	84
	15	68
Brass Trivet	15	70
Salad Fork and Spoons	18	454
	10	53
	15	71
Copper Pitcher	15	75
Ash Tray	18	457
	15	77
Candle Holders	13	10,15,17,18,20,21,22
	14	47
	15	78
Copper Jewelry Box	18	455
	15	81, 84
Cigarette Holder	15	82
Mail Box	17	21
	10	62
	17	34
	15	86
Sugar and Creamer Set	15	88
Foil Plaque		
Coasters		
Party Dish	18	453
	8	219, 239
Platters		
Snack Tray	10	6
Candy Bowl	8	234
Paper Knife (Letter Opener)	18	437
	17	26, 49
	15	93
Napkin Holder	17	41
	12	38
Bookends	16	62
Cheese or Pie Servers	18	456
	10	101

ART METAL PROJECTS
(Continued)

	Book Number	Book Numbers
Planter	12	46
	7	94, 420
Sconce	13	11
	13	93, 97
Porch Lantern	18	443
Belt Buckle	8	224
Jewelry	18	452
	10	100

WALL HANGING

ART METAL PROJECT



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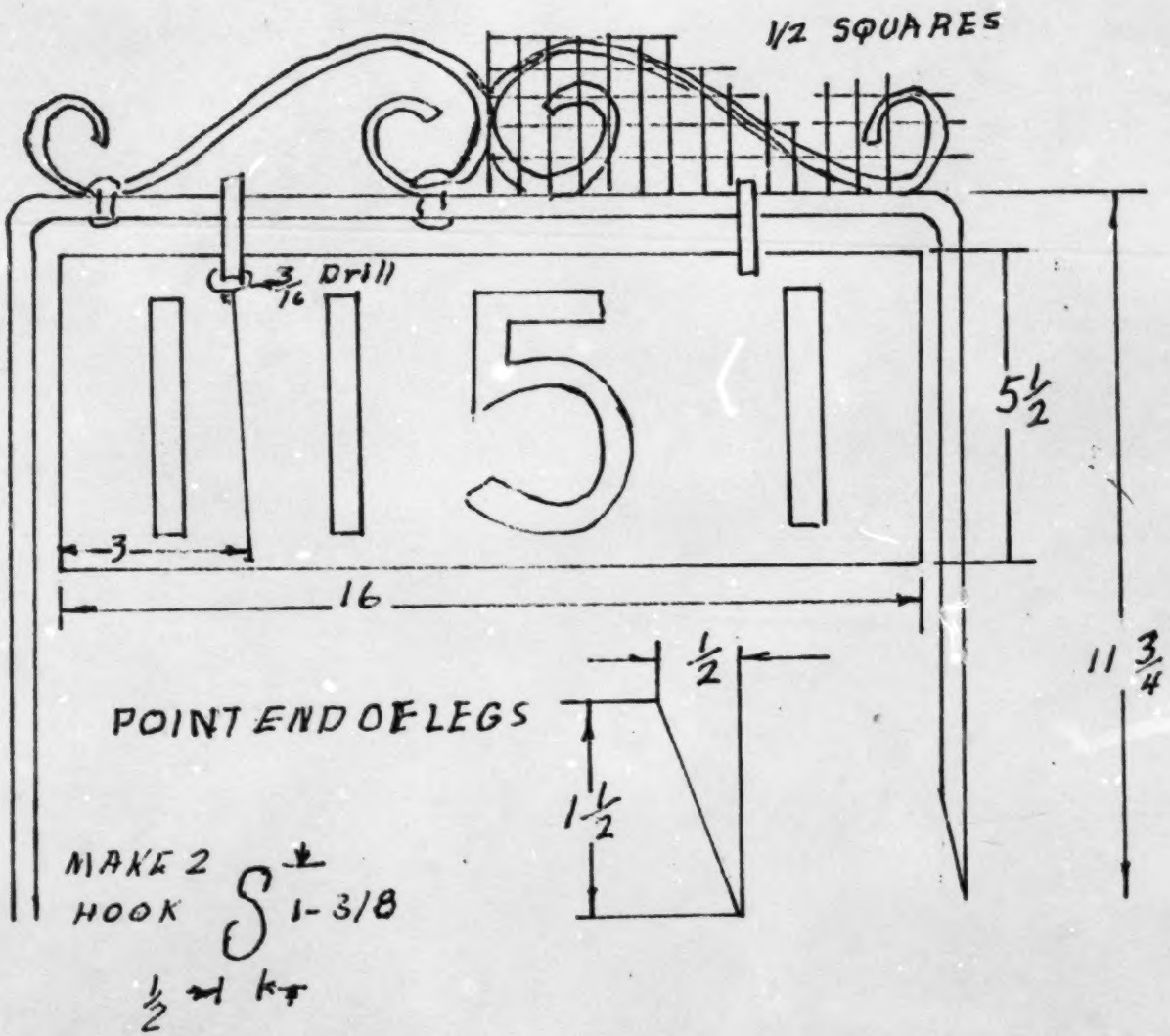
ORNAMENTAL METAL WORK PROJECTS

	Book Number	Page Numbers
Trivet	18	442
Fireplace Set	10	31
Strap Sconce	17	63
Fireplace Crane		
Andirons		
Name Sign	7	93
	12	70
Door Knocker		
Balance Scale	13	101
Colonial Centerpiece		
Grill		
Flowerpot Holder		
Ash Tray Stands		
Latches		
Hinges	16	165
Screen Door Guard	12	66
Tile Bar	10	96

YARD SIGN
ORNAMENTAL METAL PROJECT

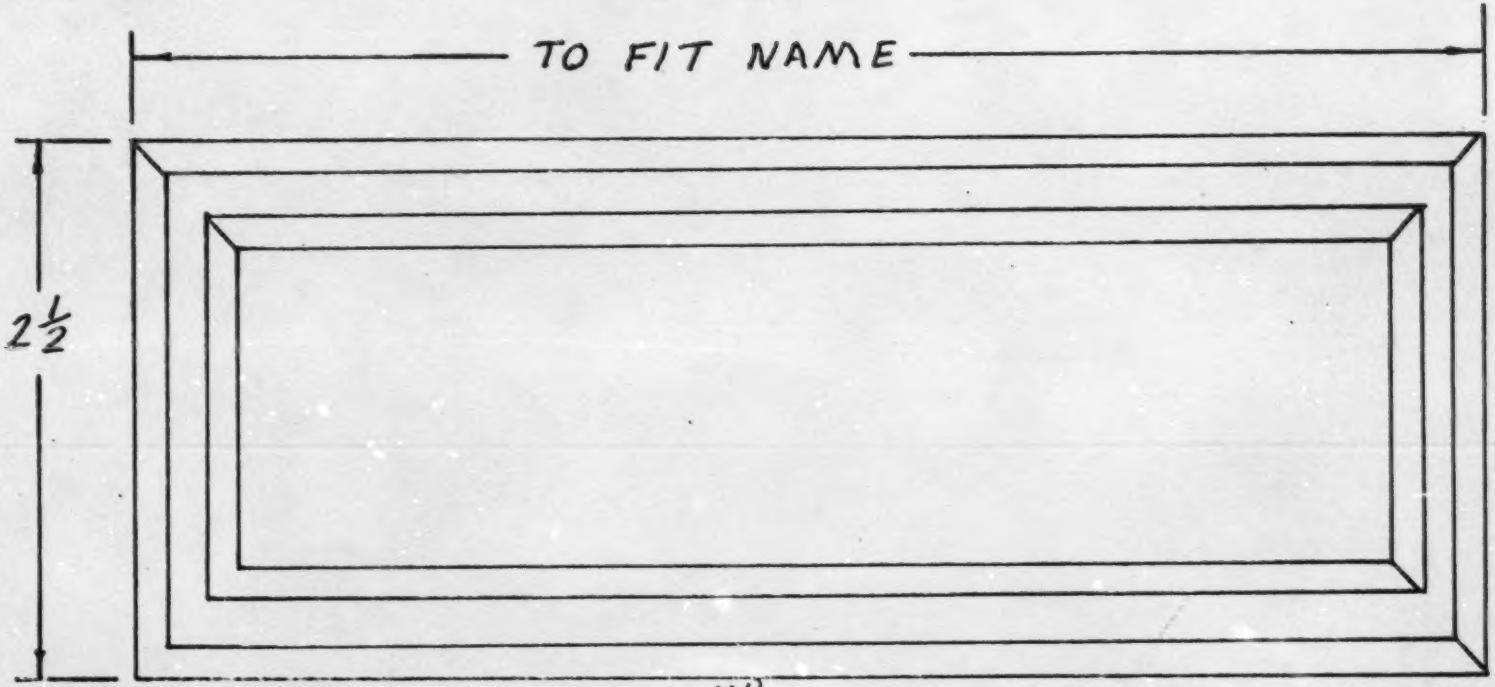


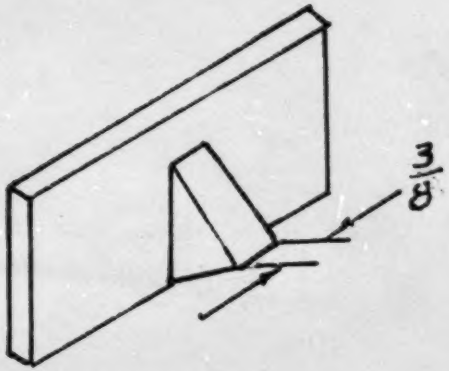
CASTING PROJECTS

	Book Number	Page Numbers
Door Marker	10	45, 71
	17	418
Book Ends	10	55
Trivet		
Paper Weight		
Anvil	10	61
Door Knocker	7	105
	10	111
Candle Holder	7	106
Belt Buckle	16	144

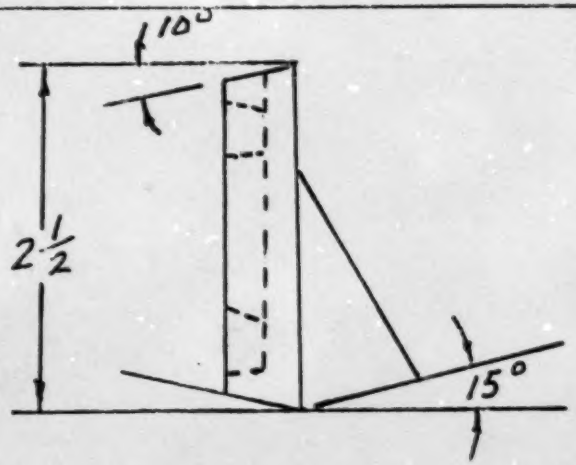
100

NAMEPLATE
CASTING PROJECT

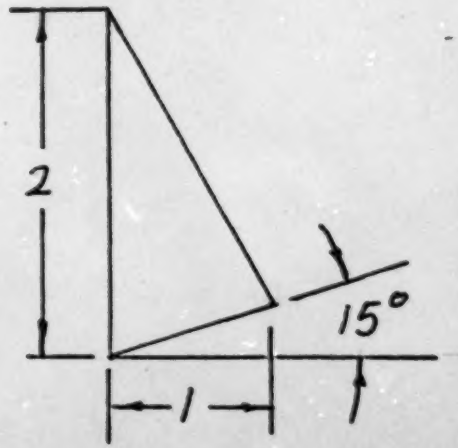




101



SUPPORT DETAILS



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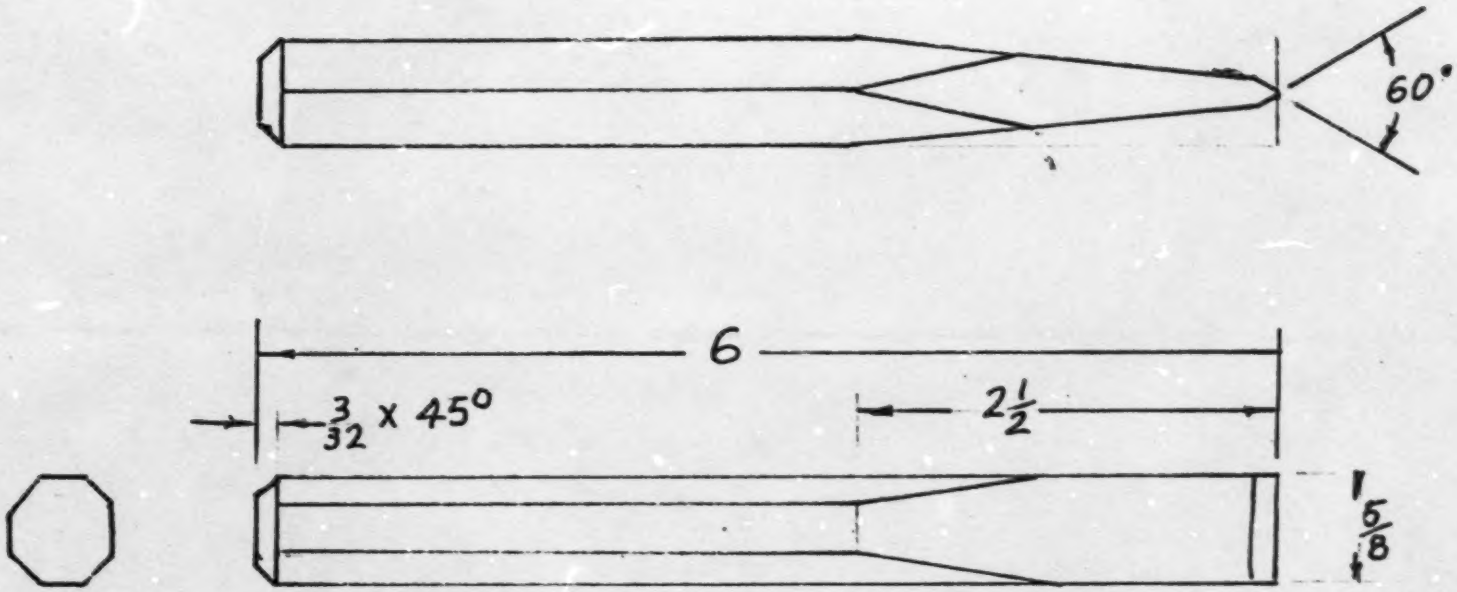
FORGING PROJECTS

	Book Number	Page Numbers
Door Knocker	10	45,71
	12	52,54
Chandelier	13	108
Wrecking Bar	12	81
Offset Screw Driver	7	102
Weather Vane	10	24
	13	60-68
Trivet	13	38-41
Sconce	17	90
Fireplace Grate	13	29

COLD CHISEL

FORGING PROJECT

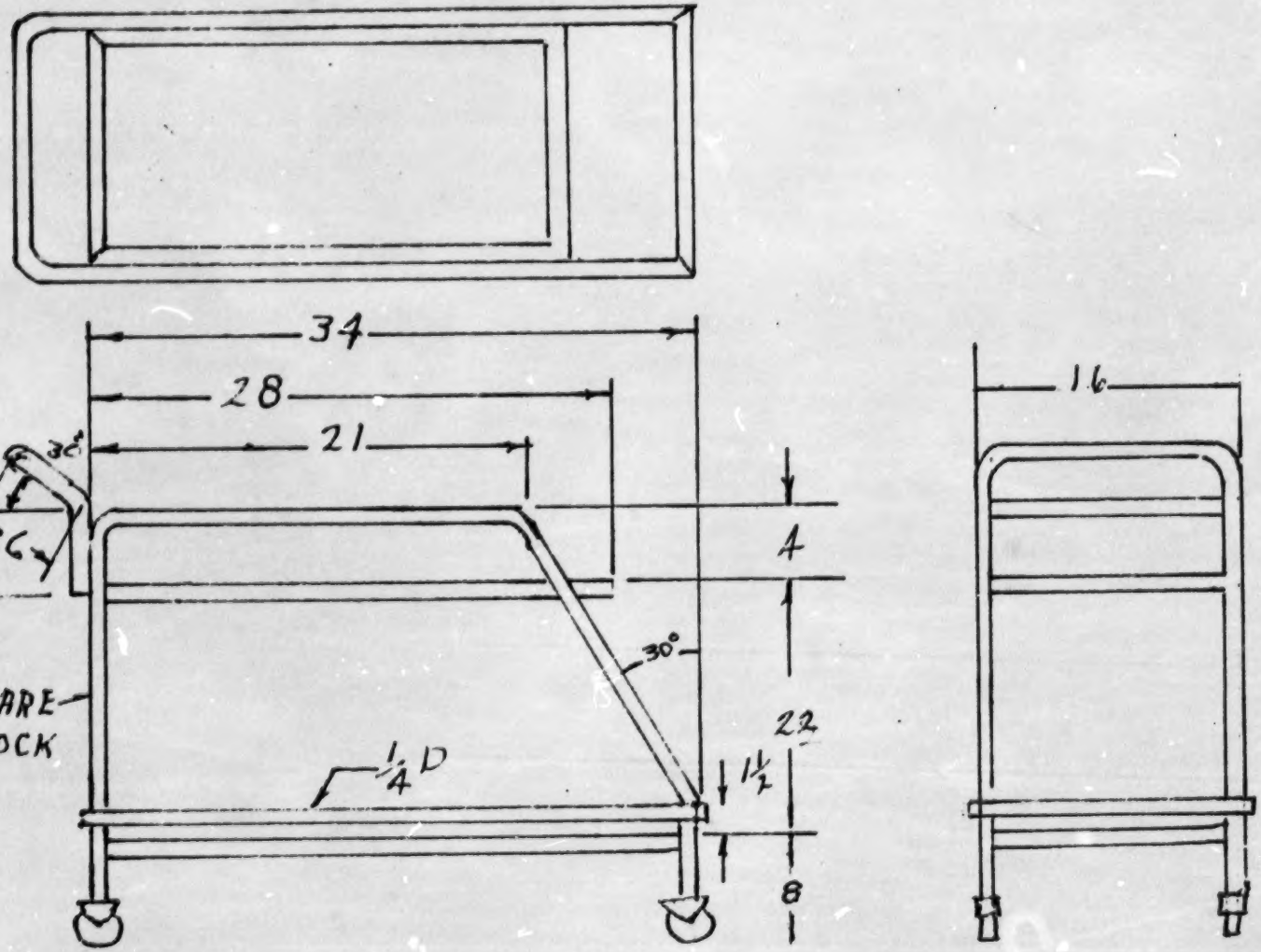
MATERIAL: 5/8 HEXAGONAL
HOT ROLL



WELDING PROJECTS

	Book Number	Page Numbers
Wall Shelf	19	432
Stack Tables	18	441
	10	56
	19	424
Patio Table	10	17
Plant Holder	17	6
Table Lamp	12	28
Fireplace Set	10	31
	17	14, 84
	13	25, 33
Andirons	10	11, 69
Weather Vane	10	24
Name Sign		
Chandelier	17	7
Flowerpot Holder		
Book Rack		
Plant Stand	12	30
Stadium Seats	12	59
Coffee Table	12	62
	9	36, 48
Kitchen Stool	10	27
	12	60
House Sign		
Tractor Seat	9	28
Television Table	9	42
Basketball Goal		
Book Stand	10	21
Pen Holder	10	33
Foot Scraper	10	34
Fireplace Grill	10	47
Weight Bench	17	33
String Chair	9	54

SERVING CART
WELDING PROJECT



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Section I

Name of Project _____

Student's Name _____ Date Started _____

Grade Level _____ Date Completed _____

Course _____ Instructor's Grade _____

Instructor's Approval _____ Student's Grade _____

Section II

Tools and Machines I will use

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Section III

Material I will need

PART NO.	No. Pieces	PART Description	MATERIAL LENGTH (1 Pc.)	MATERIAL Size	Cost
	Total				

Section IV

How I plan to make my project

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Individual Project Grading Sheet

Period _____ Date _____ Name _____

Design

_____ Use of design factors
_____ Type and size of materials
_____ Difficulty factor
_____ Originality
_____ Function of project
_____ Other _____

Construction

_____ Distortion of material
_____ Proper use of tools
_____ Project completion
_____ All welds in right location
_____ Pieces fitting together
_____ Structural quality
_____ Other _____

Accuracy

_____ Square and level
_____ Consistency
_____ Dimensions on drawing match project
_____ Scrolls have straight and even ends
_____ Other _____

Neatness

_____ Free of slag and smoke
_____ No runs in paint
_____ General appearance
_____ Other _____

Attitude

_____ Working on project everyday
_____ Initiative
_____ Obeying safety rules
_____ Pride in workmanship
_____ Other _____

Finishing

_____ All welds filed and ground
_____ Painted
_____ Signed and dated original drawing
_____ No sharp or rough edges
_____ Other _____

Comments

_____
_____
_____

PARENTS' APPROVAL FORM
(Please print all information)

Dear Parents:

Your son or daughter has enrolled in the Basic Metals laboratory for the 19____ - 19____ school year. This letter is to inform you that he or she will be operating the following power tools and equipment:

1. Lincoln 225 amp arc welder
2. TIG welder
3. Power hacksaw
4. Pedestal grinder
5. Drill press
6. Jig saw
7. Portable power grinder
8. Portable drill
9. Portable sheet metal cutter
10. Gas Furnace
11. Gas welders

_____ has our permission to
(Student's name)

operate the equipment in the Basic Metals laboratory. It is understood that instruction in safe operation will be given before he or she is allowed to use any piece of equipment and that he or she will be supervised properly at all times.

In case of an accident, we prefer that he or she be given treatment by

Dr._____

_____

Our home phone number is_____

Date_____

_____
(Father)

_____
(Mother)

_____
(Legal Guardian)

Please advise me of any physical handicaps which need to be brought to my attention so that measures may be taken to insure safe working conditions for your child.

Thank you,

(Teacher's signature)

INDUSTRIAL ARTS FIELD TRIP

DATE:_____

PLACE:_____

LEAVE SOUTHWOOD AT: _____

RETURN TO SOUTHWOOD AT: _____(approximately)

FEES: (1)BUS . . . . . .____(Pd. by _____)

(2)MEALS . . . . . .____

(3)ENTRY FEE. . . . . IAC members NON-MEMBERS

(4)OTHER . . . . . ____

- -

My son/daughter _____, has my permission to attend the Industrial Arts Field Trip at _____ in _____,La. on _____. It is my understanding that transportation will be provided by a Caddo Parish school bus and students will be accompanied by Industrial Arts teachers.

_____
(PARENT OR GUARDIAN)

_____
(DATE)

****

My son/daughter _____has my permission to use their car or truck to transport student projects from Southwood High School to _____and back.

_____ _____
(PARENT OR GUARDIAN) (DATE)

MEASURING ACHIEVEMENT

The following are sample or suggested test questions for each unit of study. The following test questions are by no means complete nor exhaustive. They are merely a representation of some of the better material available. Also included are suggestions for directions for examinations.

General Directions

This test consists of five parts: true and false, matching, multiple choice, completion, and listing. There will be 50 monutes alloted for the test. If there are questions please ask them before the class starts the test. If there are urgent questions while taking the test, raise your hand. Upon completion of the test, turn your paper over and remain quietly in your seat. Begin.

True and False Test:

Read the complete statement. If the statement is true, circle the T; if the statement is false, circle the F.

Matching:

In the blank at the left of the item number, record the letter of the description in the right column which identifies the item.

Multiple Choice:

In the blank at the left of the item number, record the letter of the answer that makes the statement correct.

Completion:

Fill in each blank with a word or words that complete(s) the statement correctly.

Listing:

In the spaces provided list concisely the information called for in each question.

Sample Test Layout

Date_____

Name_____

Period_____

Seat Number_____

Test Number_____

Score_____ Letter Grade_____

BASIC METALS

TEST NO. 1 INTRODUCTION TO METALS

_____ 1. Cast iron has a sandy appearance on the outside. (T - F)

_____ 2. The purest form of iron is

a. wrought iron
b. cast iron
c. meteor
d. iron ore
e. none of the above.

3. Name three (3) alloys used in making steel.

1._____
2._____
3._____

4. Name four (4) ways metal can be identified.

1._____
2._____
3._____
4._____

5._____is done by coating steel or iron with zinc.

ANSWERS

1. True
2. C
3. stainless
   nickel
   magnesium
4. Surface appearance
   sound
   spark test
   melting point
5. Galvanize

Test No.2 General Safety

Basic Metal Working Tools Layout

1. The _____caliper is used to make external measurement.

2. _____ is used to make the layout lines easier to see.

_____ 3. Angular lines may be laid out with a

a. straight edge
b. rule
c. square
d. bevel protractor

4. The _____screwdriver is used to drive "X" slotted screws.

5. Keep electrical cords away from oil and hot surfaces.

ANSWERS

1. Inside
2. Layout fluid
3. D
4. Phillips
5. True

Test No. 3 Bench Metalwork

1. List the four basic types of chisels:

   1. _____
   2. _____
   3. _____
   4. _____

_____ 2. The hole to be tapped must be the same size as the tap. (T - F)

_____ 3. The box wrench is preferred over the open end wrench because:

   a. it is cheaper
   b. it can be used on several sizes of fasteners
   c. it completely surrounds the fastener and cannot slip
   d. none of the above
   e. all of the above.

4. Files are classified according to the cut of their teeth. List the four cuts.

   1. _____
   2. _____
   3. _____
   4. _____

5. List four methods used to join materials.

   1. _____
   2. _____
   3. _____
   4. _____

ANSWERS

1. Flat
   cape
   round nose
   diamond point
2. False
3. C
4. Single cut
   Double cut
   Rasp
   Curved tooth
5. Screws
   bolts
   nuts
   rivets

Test No. 4 Sheetmetal

1. Pattern developments fall into two basic classifications:

   1._____

   2._____

2. Sheet metal can be cut by hand or by a _____shears.

_____3. Cylindrical shapes are formed on a

   a. cornice brake
   b. forming rolls
   c. cylinder maker
   d. slip roll forming machine

4. Most sheet metal joints are finished by _____and/or_____.

5. The wired edge is added to the lip of a sheet metal object for flexibility.

ANSWERS

1. Parallel line development
   Radial line development
2. Power
3. D
4. Soldering
   riveting
5. False

Test No. 5 Art Metal
Ornamental Metal Work

1. Internal designs are cut into metal by a technique called_____.

_____2. Wrought metal sections are twisted

a. to permit a suitable point of attachment
b. for additional stiffness
c. to break the monotony of a long flat section
d. a-1 of the above.

2. A full-size pattern should be made before attempting to form a scroll or other curved section.

4. Name the two methods used to form bowls and trays.

a._____

b._____

_____5. The scroll is widely used for decorative purposes.

ANSWERS

1. Sawing
2. D
3. True
4. Beating down
   raising
5. True

Test No. 6 Forging Metal Casting

1. Heating the metal makes the metal _____.

_____2. Drawing out a piece of metal means that

a. it has been shortened
b. it has been upset or enlarged
c. it has been stretched or lengthened

_____3. Sand molds can be used more than once.

_____4. The cope is the bottom part of the drag.

_____5. Which is not a step in all heat treating processes?

a. normalizing the piece of metal before it is heated
b. heating the metal to a certain temperature
c. cooling the metal at a certain rate
d. holding the temperature for a certain time period.

ANSWERS

1. Softer
2. C
3. False
4. False
5. A

Test No. 7 Welding Metal Finishing

1. The two methods recommended for striking the arc are

   a. _____

   b. _____

___ 3. Electrodes are

   a. metal rods
   b. copper-plated metal rods
   c. metal rods covered with baked-on flux.
   d. none of the above

____4. Weld control can best be maintained by watching the shape and size of the arc.

____5. Paints and varnishes may be applied by the following methods

   a. _____

   b. _____

   c. _____

ANSWERS

1. Scratching
   tapping
2. Red
   green
3. C
4. False
5. Brushing
   spraying
   dipping

Test No. 8 Planning Careers
in Metalworking

1. _____ drawings give the craftsman all of the information needed to make the part.

2. A drawing seldom shows all of the dimensions needed to machine the object.

_____3. Prints are used instead of the actual drawing because

a. the actual drawing does not show all of the details
b. they are easier to read
c. they might be lost, damaged, or destroyed
d. none of the above.

4. List four categories of metalworking occupations

a. _____
b. _____
c. _____
d. _____

5. _____ workers are those who perform operations that do not require a high degree of skill or training.

ANSWERS

1. working
2. False
3. C
4. Semi-skilled
skilled
technicians
professions
5. Semi-skilled

Test No. 9 Safety

_____ 1. One should use a brush, rag or your hand to brush away metal chips.

_____ 2. You should never cut or weld directly on a concrete floor.

3. Always stop machines before making _____ and _____.

_____ 4. You should carry tools in your pocket

a. when you have a lot of tools to carry
b. when you are going to walk a long distance
c. when you have no sharp tools to carry
d. none of the above.

5. _____ should always be worn when using a pedestal grinder, bench grinder, and portable grinder.

ANSWERS

1. False
2. True
3. Measurement adjustments
4. D
5. Safety goggles

INDUSTRIAL ARTS

I. Teacher Readiness

A successful first meeting with your students is important. The first impression of you as a teacher is a lingering impression. Most of the qualities that denote a good teacher will be required in handling your first encounter with a new group of students.

The chief thing to be tested, however, will be your ability to foresee, and your skill to prepare for that which you have foreseen.

As a check upon your readiness to meet the class for the first time, the following points may be of value:

1. Visualize the class as fully as possible, as to age, training, temperament, aptitudes, and the like. Previous records will assist here.

2. Be certain that equipment and tools are in perfect condition.

3. Have a definite plan for the work for the semester.

4. Have material on hand and ready for the first piece or pieces of work to be done.

5. Have a written lesson plan of procedure for the first class meeting.

6. Have the needed tools and other devices on hand for the first lesson.

7. Be ready to assign students to working places and lockers.

8. Plan a definite method for getting acquainted with the class.

9. Prepare to be glad to see the students arrive, and to let them know it.

10. Have a definite plan for standards of order and discipline, and be prepared to put this plan in operation from the start.

Techniques for Maintaining Interest

The following suggestions are offered for maintaining interest and keeping it at a high pitch over a long period of time.

1. Call class together at the beginning of each period.
2. Have a definitely planned small unit of instruction ready for presentation for each class meeting before students go to work.
3. Make each presentation different from that of the day before. This can be brought about by difference in subject matter or in manner of presentation.
4. Use variety of teaching aids both for instruction and for stimulating interest.
5. Draw upon popular magazines, motion pictures, newspapers, school shop magazine, etc. for examples of application to work which students are doing.
6. Rotate students jobs in class maintenance at frequent intervals.
7. Indicate or present difficult, but interesting, problems for solutions by class, encouraging problem solving.
8. Use chalkboard sketches for stimulating interest.
9. Give recognition to students' effort. Do so often.
10. Keep a progress chart. Students like to see their degree of progress indicated by marks.
11. Let students assist in solving problems rather than simply be told what to do.
12. Assign work so that each student can experience success.
13. Keep an atmosphere of joy and accomplishment in the class at all times.
14. Make the work of the class progress at as rapid rate as possible.
15. Use questions freely to stimulate thinking and sustain interest.

COURSE EVALUATION

Purpose:

This evaluation is an effort by your instructor to ascertain his teaching effectiveness and the usefulness of course materials. It is designed to provide suggestions on how the course can be improved and be made more relevant to students needs. Your cooperation will be greatly appreciated.

Instructions:

Below are a list of qualities dealing with the course and the instructor. You are asked to evaluate these qualitites on a scale of four to one. Four is the highest ranking, and one is the lowest ranking. Any comments you wish to add may be included on the back of this sheet.

		Rankings			
		Highest			Lowest
1.	The class sessions and lectures were well organized.	4	3	2	1
2.	The course textbook was very helpful as a learning device.	4	3	2	1
3.	The course was interesting and enjoyable.	4	3	2	1
4.	The course material satisfied my educational needs in this area.	4	3	2	1
5.	The tests used in the course contributed to greater learning.	4	3	2	1
6.	Material presented in the course was easy to learn and to apply.	4	3	2	1
7.	The instructor displayed a sense of professionalism and dignity in the class.	4	3	2	1
8.	The instructor seemed personable and genuinely interested in students.	4	3	2	1
9.	The instructor has a thorough knowledge of his subject matter.	4	3	2	1
10.	The variety of presentation methods was good.	4	3	2	1
11.	The instructor displayed a sense of humor.	4	3	2	1
12.	The instructor was clear in his explanation of course material and assignments.	4	3	2	1
13.	The instructor always seemed prepared for class meetings.	4	3	2	1
14.	The instructor always displayed a pleasant dress appearance.	4	3	2	1
15.	The instructor provided for all students to participate.	4	3	2	1
16.	The instructor was patient and resourceful.	4	3	2	1

RESOURCE MATERIALS

The following list of resource materials are by no means complete nor exhaustive. They merely represent books from Louisiana State adopted textbook list and other available materials used by metalworking teachers.

1. Walker, John R. - Exploring Metalworking Basic Fundamentals. South Holland, Illinois: Goodheart-Willcox Co., Inc., 1976.

2. Walker, John R. - Modern Metalworking. South Holland, Illinois: Goodheart-Willcox Co., Inc., 1976.

3. Chaplin, Jack W. - Metal Manufacturing Technology. Bloomington, Illinois: McKnight Publishing Co., 1976.

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5. Bedell, Earl L., and Roland R. Fraser.- General Metal Principles, and Projects. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962.

6. Johnson, Harold V. - Technical Metals. Peoria, Illinois: Chas. A. Bennett Co., Inc., 1973.

7. Boyd, Gardner T. - Metalworking. Chicago, Illinois: Goodheart-Willcox Co., Inc., 1961.

8. Feirer, John L. and John R. Lindbeck.- Metalwork. Peoria, Illinois: Chas. A. Bennett Co., Inc., 1970.

9. Sekely, Delso MA. - Contemporary Industrial Arts Projects. Bloomington, Illinois: McKnight and McKnight, 1956.

10. Walker, John R. Metal Projects Book 1. South Holland, Illinois: Goodheart-Willcox Co., Inc., 1966.

11. Ludwig, Oswald A., Willard J. McCarthy, and Victor E. Repp. Metalwork Technology and Practice. Bloomington, Illinois: McKnight Publishing Co., 1975.

12. Ruley, M.J. - Practical Metal Projects. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1970

13. Daniele, Joseph William.- Early American Metal Projects. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1971.

14. Googerty, Thomas F. - Decorative Wrought Iron Work. Peoria, Illinois: The Manual Arts Press., 1937.

15. Siegner, C. Vernon. Art Metals. Chicago, Illinois: Goodheart-Willcox Co., 1961.

16. Art Metal Project Ideas. Albany, New York. The University of the State of New York, 1958.

17. Fifer, Bill. - Metal Projects Book 2. South Holland, Illinois: Goodheart-Willcox Co., Inc., 1974.

18. Feirer, John L. - General Metals. New York, New York: McGraw-Hill. 1967.

19. Gruneman, Chris H. and John L. Feirer. - General Shop. New York, New York: McGraw-Hill, 1963.